U.S. Space Force

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The U.S. Space Force (USSF) was created pursuant to Title IX of the fiscal year (FY) 2020 National Defense Authorization Act (NDAA), which was signed into law on December 20, 2019.[1] It is "responsible for organizing, training, and equipping Guardians [military space professionals] to conduct global space operations that enhance the way our joint and coalition forces fight, while also offering decision makers military options to achieve national objectives."[2]

Almost all civilian and commercial space technologies have direct applicability to military systems or are of dual use. This makes the interwoven efforts of all three U.S. sectors critical to any informed assessment of the Space Force.[3]

Background

More than any other nation, America relies on the technological advantages of space. Banking, commerce, travel, entertainment, the functions of government, and our military all depend on our assets in space.[4] That fact has been recognized by every President since Dwight Eisenhower in the mid-1950s, but various issues kept the United States from developing a single service charged with managing space assets and capabilities until very recently.

In 1961, the Air Force was named executive agent for space research and development, but at that point, the Army and Navy already had well-established programs.[5] This splintered approach remained in place for the next six decades and, although anything but efficient, allowed the U.S. to advance its space capabilities at a stunning pace.

The effectiveness of the space support missions delivered during those developmental decades was on full display during Operation Desert Storm.[6] Our space capabilities allowed our forces to move with incredible speed and accuracy, but a growing U.S. dependence on space was equally evident. U.S. reliance on the Global Positioning System (GPS) for air, land, and sea maneuver, targeting, and engagement has grown to the point where it is nearly universal, exposing a critical vulnerability that our adversaries have moved to exploit.

Both China and Russia have developed doctrine, organizations, and capabilities to challenge U.S. access to and operations in the space domain. Concurrently, their own use of space is expanding significantly. These nations have demonstrated the capability to put American space assets at risk, and until very recently, the United States had not taken overt steps to protect those systems, much less to develop its own warfighting capability in that domain.

The FY 2017 NDAA mandated that the Department of Defense (DOD) conduct a review of the organization and command and control of space assets within the department.[7] Shortly after the FY 2017 NDAA was enacted, President Donald Trump directed that a Space Force be established within the Department of the Air Force (DAF).[8] Congress concurred and created the USSF with enactment of the FY 2020 NDAA.

An important addition to the U.S. warfighting command structure was the reestablishment of U.S. Space Command in 2019 as the 11th Combatant Command within the Department of Defense. Space Command's mission is to conduct "operations in, from, and to space to deter conflict, and if necessary, defeat aggression, deliver space combat power for the joint/combined force, and defend U.S. vital interests with allies and partners."[9]

Organization and Funding

The USSF Headquarters and Office of the Chief of Space Operations (CS) are located in the Pentagon. When Congress authorized the Space Force, it limited its scope to Air Force organizations and personnel located at five major installations:

- The 21st Space Wing at Peterson Air Force Base, Colorado;
- The 30th Space Wing at Vandenberg Air Force Base, California;
- The 45th Space Wing at Patrick Air Force Base, Florida;
- The 50th Space Wing at Schriever Air Force Base, Colorado; and
- The 460th Space Wing at Buckley Air Force Base, Colorado.[10]

Those personnel, organizations, and structures have been restructured and rolled into three major field commands that fall directly under the CSO:

- Space Operations Command (SpOC);
- Space Systems Command (SSC); and
- Space Training and Readiness Command (STARCOM).[11]

These three commands lead the next tier of organizations, called Deltas. The Space Force originally included "Garrisons" in the tier as Deltas but renamed them all Deltas in 2022.[12] Deltas are equivalent to Air Force Groups, are led by a colonel, and are tasked with and responsible for specific missions and operations or are organizations with functions similar to those of Air Force base-level command. Squadrons are the final level of command and fall under Deltas.[13]

Space Operations Command. SpOC was established at Peterson Air Force Base, Colorado, on October 22, 2020, as the first major USSF field command.[14] It is led by a three-star general and is responsible for organizing, training, and equipping space forces assigned to Combatant Commands. The SpOC at Vandenberg Air Force Base, California, was redesignated as SpOC West and continues to conduct operations in support of Combatant Commanders.

Space Systems Command. This command stood up on August 13, 2021, at Los Angeles Air Force Base[15] to oversee the development, acquisition, and maintenance of satellites and ground systems, the procurement of satellite communications (SATCOM) and launch services, and investments in next-generation technologies. SSC is led by a three-star general who oversees the Space Force's approximately $19.2 billion FY 2024 budget for research, development, test, and evaluation (RDT&E) and the acquisition of new systems.[16] SSC absorbed the Space and Missile Systems Center (SMC), located at Los Angeles Air Force Base, California; the Commercial Satellite Communications Office based in Washington, D.C.;[17] and the Space Vehicles Directorate at Kirkland Air Force Base, New Mexico.[18]

In October 2022, the Space Development Agency (SDA) was transferred to the U.S. Space Force as a direct reporting unit. SDA is delivering on its strategy to design a proliferated constellation of small, low Earth orbit (LEO)–based satellites that can be fielded faster and more cheaply than large, geosynchronous orbit (GEO)–based satellites. In April 2023, SDA put the first 10 of 28 communications and space situational awareness satellites within the Proliferated Warfighter Space Architecture (PWSA) into orbit just 30 months after it was given authority to proceed with the contract.[19] Since then, 14 more PWSA satellites have been put into orbit.

Space Training and Readiness Command. STARCOM is the third USSF field organization and stood up on August 23, 2021, at what is now Peterson Space Force Base, Colorado. It is led by a two-star general and is responsible for the education and training of space professionals.[20]

Personnel. The FY 2024 Air Force budget request supports 9,400 military and 4,909 civilian Space Force personnel, respectively, up from 8,600 military and 4,714 civilian personnel in FY 2023, and a total end strength of 14,526, up from 13,527 in FY 2023.[21]

Funding. The President's budget request for FY 2024 lays out a relatively robust level of funding for every aspect of the new service's mission set. The budget for Operations and Maintenance (O&M) is $4.9 billion; the budget for RDT&E is $19.2

billion; and procurement adds another $4.7 billion for a total of $30.0 billion, a 14 percent increase from FY 2023.[22]

Capacity

The classified nature of deployed space assets makes any listing of specific capacity levels within the Space Force portfolio or assessment of the service's capability to execute its mission a challenging exercise. The USSF's position, navigation, and timing (PNT); command and control (C2); communications (Comm); weather satellites; and intelligence, surveillance, and reconnaissance (ISR) satellites are unrivaled by our peer adversaries and provide extraordinary capabilities. The service's space situational awareness (SSA) satellites and terrestrial-based capabilities are also unrivaled, but they are limited and require additional resourcing to meet the expectations of their mission sets. Each satellite, satellite constellation, and terrestrial space surveillance site has its own unique characteristics and expected life span.

In 2018, the Air Force operated 77 satellites.[23] Today, thanks partly to service equipment transfers and additional fielding, the number available to the Space Force has almost doubled to an estimated 147. (See Table 18).

Position, Navigation, and Timing Satellites

Global Positioning System (GPS) (37 Satellites). Perhaps the best-known constellation of satellites under Space Force control, GPS provides PNT for millions of simultaneous users around the world. It takes 24 of these satellites to provide seamless global coverage, and 31 are currently operational.[24] At least six additional satellites have been decommissioned and serve as on-orbit spares, bringing the total number that are available to 37.[25]

GPS III is the latest upgrade to the platform and incorporates a more robust anti-jamming capability. The fifth GPS III satellite was launched into orbit in June 2021,[26] the sixth was launched in January 2023,[27] and the next four have been assembled and are waiting their turn in the launch queue.[28] The fact that GPS III satellites are interoperable with other Global Navigation Satellite Systems (GNSS) such as the European Galileo network and the Japanese Quazi-Zenith Satellite System adds an impressive level of resiliency to the constellation.[29]

Weather Satellites

Defense Meteorological Satellite Program (DMSP) (Four Satellites). Defense weather satellites have been collecting weather data and providing forecasts for U.S. military operations since 1962 through the DMSP.[30] Currently, four DMSP satellites are operational and in polar LEO.[31] The main sensors for these weather satellites are optical, and each provides continuous visual and infrared imagery of cloud cover over an area approximately 1,600 nautical miles wide, enabling complete global coverage of weather features every 14 hours.[32] Launched between 1999 and 2009 with a life expectancy of just five years, they have continued to deliver exceptional data well beyond their expected lifetimes. Space Force officials have warned that the DMSP constellation would become inoperable at some point between 2023 and 2026 and that the proposed replacement system[33] would not begin operation until 2024 at the earliest.[34]

Electro-Optical Infrared Weather System–G (EWS-G) (Two Satellites). Formerly named GOES, the second EWS-G was transferred from the National Oceanic and Atmospheric Administration (NOAA) to the USAF in 2023. The EWS-G is the first geostationary weather satellite owned by the DOD and provides theater weather imagery in the Indian Ocean region.[35]

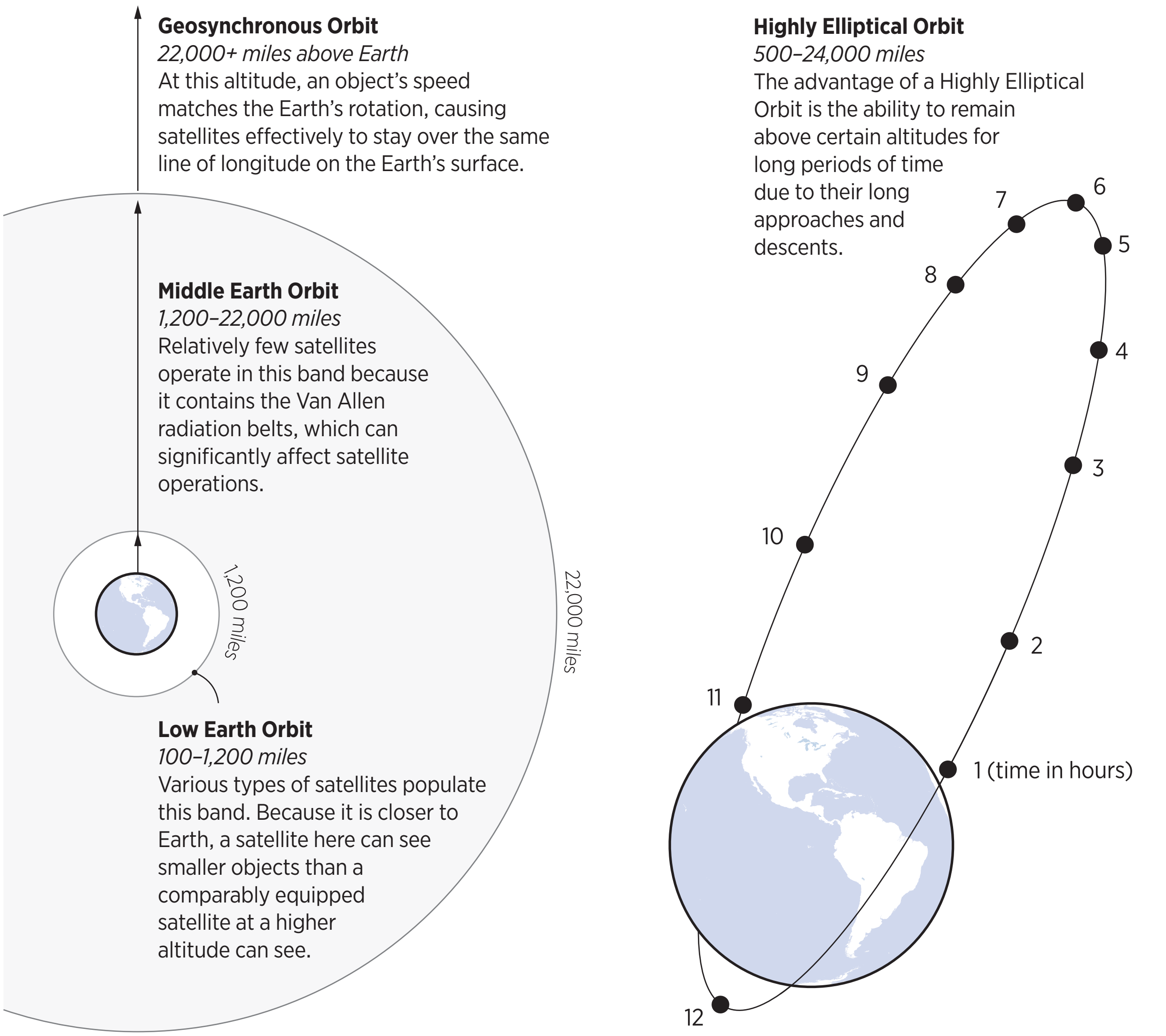
Communications Satellites

Military Strategic and Tactical Relay (Milstar) (Five Satellites). This satellite communications system was designed in the 1980s to ensure that the National Command Authorities (President, Vice President, Secretary of Defense, Joint Chiefs of Staff, and Combatant Commanders) would have access to assured, survivable global communications with a low probability of intercept or detection. Milstar was designed to overcome enemy jamming and nuclear effects and was considered the DOD's most robust and reliable SATCOM system when it was fielded.

The first two satellites (Milstar I) carry a low data rate (LDR) payload that can transmit 75 to 2,400 bits per second (bps) of data over 192 channels in the extremely high frequency (EHF) range. Encryption technology and satellite-to-satellite crosslinks provide secure communications, data exchange, and global coverage. The other three satellites (Milstar II) carry both LDR and medium data

FIGURE 6

Types of Earth Orbits



SOURCE: Heritage Foundation research.

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rate (MDR) payloads and can transmit 4,800 bps to 1.544 megabits per second (Mbps) of data over 32 channels.[36] Milstar was fielded from 1993 through 2003 with a designed life of 10 years.[37]

Advanced Extremely High Frequency System (AEHF) (Six Satellites[38]). Like Milstar, AEHF provides and sustains secure, jam-resistant communications and C2 for high-priority military assets located anywhere in the world. The system, which was launched into geosynchronous orbit from 2010–2020 with a design life of 14 years, "will be integrated into the legacy Milstar…constellation" and "be backward compatible with Milstar's low data rate (LDR) and medium data rate (MDR) capabilities, while providing extreme data rates (XDR) and larger capacity at substantially less cost than the Milstar system."[39]

Defense Satellite Communications System (DSCS) (Six Satellites). These satellites provide nuclear-hardened, global communications to the

DOD, Department of State, and National Command Authorities. The system is capable of high data rates and provides anti-jamming capabilities. In all, the DSCS program successfully launched 14 satellites, six of which are still operational and serve operational communication requirements in Southwest Asia as well as research and development of ground-based support capabilities. These satellites were fielded from 1998 through 2003 into GEO with 10-year life spans.[40]

Wideband Global SATCOM (WGS) (10 Satellites). WGS is a joint-service program funded by the U.S. Air Force and U.S. Army, along with international partners Australia and Canada, and is used by all DOD services as well as National Command Authorities. Once known as the Wideband Gapfiller Satellite, WGS provides Super High Frequency (SHF) wideband communications, using direct broadcast satellite technology to provide C2 for U.S. and allied forces. With solid capabilities that include phased array antennas and digital signal processing technology, this system delivers a flexible architecture with a satellite life span of up to 14 years.[41] WGS-11 is scheduled to launch and join the constellation sometime in 2024.[42]

Fleet Satellite Communications System (FLTSATCOM) (Six Satellites).[43] FLTSATCOM is a constellation of six operational satellites used by the Navy, Air Force, and presidential command network. The system was launched into GEO between 1978 and 1989 to serve as a secure communications link between the three users with a design life of five years.[44] This constellation transferred from the U.S. Navy to the Space Force on June 6, 2022.[45]

Ultra-High Frequency Follow-On (UFO) (10 Satellites). The UFO constellation was designed to replace FLTSATCOM to provide communications for tactical users including aircraft, ships, submarines, and ground forces. UFO provides almost twice the throughput and 10 percent more power per channel than FLTSATCOM. This UFO constellation of satellites was launched into GEO between 1993 and 2003 with a life expectancy of from 14 to 15 years.[46] The system was transferred from the U.S. Navy to the Space Force on June 6, 2022.[47]

Mobile User Objective System (MUOS) (Five Satellites). MUOS is a next-generation narrowband tactical satellite communications system designed for tactical users with the goal of significantly improving ground communications, even for troops in the most remote locations or in buildings with no other satellite access. MUOS satellites were launched into GEO from 2012 through 2016 with a design life of 15 years and provide the ability to transmit 10 times more information volume than can be transmitted with UFO.[48] This constellation was transferred from the U.S. Navy to the Space Force on June 6, 2022.[49]

Continuous Broadcast Augmenting SATCOM (CBAS) (Two Satellites). CBAS is a satellite communications system in GEO that provides communications relay capabilities to support senior leaders and Combatant Commanders, augmenting existing military satcom. CBAS 1 was launched on April 14, 2018, and CBAS-2 was launched on January 15, 2023.[50]

Proliferated Warfighter Space Architecture (PWSA) Transport Layer Tranche 0 (19 Satellites). Once fully fielded, the PWSA Tranche 0 constellation of 19 transport satellites and eight tracking platforms[51] will serve as a warfighter testbed/immersion constellation that will support military exercises and provide low-latency data connectivity and on-orbit fusion.[52] While it is a demonstration testbed for future tranches, the Tranche 0 constellation will no doubt be able to service ongoing operational needs well after the utility of their test function has been served.[53] The PWSA's programmed life span is unknown.

Space Situational Awareness Systems

Knowledge of hostile space systems—their locations, their positional history, and how those satellites and other spacecraft are maneuvering in real time—conveys intent and collectively shapes the protocols and counterspace decisions that follow. Space situational awareness is therefore critical to every aspect of defensive and offensive counterspace operations and forms the foundation for DOD counterspace activities.[54]

In addition to adversary systems, other significant threats are in orbit. Objects in low Earth orbit travel at more than 17,000 miles an hour,[55] and particles as small as a few thousandths of an inch in diameter traveling at those speeds can threaten everything from satellites to the International Space Station.[56]

In June 2023, the European Space Agency estimated that there are at least 36,500 objects that are more than four inches wide, 1 million between 0.4

inches and 4 inches across, and 130 million that are smaller than 0.4 inches but bigger than 0.04 inches.[57] The Space Force is currently tracking nearly 48,000 objects in space. Specifically:

> The number of publicly reported tracked objects has grown from 8,927 in 2000 (2,671 active and inactive satellites, 90 space probes, and 6,096 pieces of debris) to about 47,800 today (7,200 active satellites, 19,600 pieces of debris of known origin, and 21,000 pieces of debris of unknown origin or which cannot be tracked repeatedly). Most of the increase in active satellites is the result of the massive number of small satellites launched to form constellations in low-Earth orbit starting in the 2010s, primarily by private firms. For example, the Starlink constellation of small communications satellites now has over 2,000 spacecraft with several thousand more to be added in the coming years. OneWeb is close to completing its constellation of about 900 small communications satellites. Planet's constellation has around 200 small Earth-observation satellites. In addition to the tracked debris, there are an additional estimated 600,000 to 900,000 fragments between 5 mm and 10 cm in size, and many hundreds of thousands of pieces smaller than 5 mm in size, that cannot be tracked.[58]

Maintaining a high level of situational awareness about satellites and debris orbiting across the vast dimensions of potential Earth orbits requires a robust and seamless network of space and terrestrial-based sensors, the earthbound portion of which is known collectively as the Space Surveillance Network (SSN). Understanding the capabilities and limitations of this network naturally begins with understanding the numbers and types of space-based and ground-based systems.

The SSA satellites, known collectively as the Space-Based Surveillance System (SBSS), operate in concert with ground-based sensors but without limitations such as weather that can obscure and sunlight that can blind ground-based optical sensors. SBSS consists of 11 acknowledged satellites. Some track objects and debris fields from LEO. Others operate from GEO and are capable of maneuvering to perform detailed inspections of orbiting objects that are of especially high interest.

Geosynchronous Space Situational Awareness Program (GSSAP) (Six Satellites). This classified surveillance constellation can accurately track and characterize objects in orbit.[59] Operating near GEO, GSSAP satellites are maneuverable and therefore able to perform rendezvous and proximity operations (RPO) on objects of interest in space.[60] The first two GSSAP satellites were put in orbit on July 28, 2014; the second two were launched on August 19, 2016; and a third pair was launched on January 21, 2022.[61] Each GSSAP satellite has an estimated life span of seven years.[62]

Long Duration Propulsive Evolved Expendable Launch Vehicle (LPDE) (Three Satellites). LPDE is an acronym of acronyms that stands for Long Duration Propulsive Evolved Expendable Launch Vehicle Secondary Payload Adapter. LPDE has been renamed, and future launches will be known as Rapid On-Orbit Space Technology and Evaluation Ring (ROOSTER). These satellites provide power, pointing, telemetry, and command and control for payloads of up to six sensors that remain with and are supported by the vehicle or an equal number of deployable small satellites (SmallSats) to LEO, medium Earth orbit (MEO), GEO, or Super GEO.[63] LPDE's hydrazine propulsion module provides up to 400 meters per second of delta-V, giving it the ability to deploy satellites or to sustain or change its own orbit with precision.[64]

LPDE-1 was launched in December 2021 carrying the Ascent SmallSat and three additional undisclosed payloads.[65] LPDE-2 was launched in November 2022 carrying three SmallSats, including Alpine, and Tetra-1.[66] LPDE-3 was launched in January 2023 carrying a combination of five hosted sensors/payloads and the SmallSat ECP-Lite.[67] Details for those satellites and payloads are provided in the paragraphs that follow.

Wide Area Search Satellite (WASSAT) (One Sensor). WASSAT is a camera/sensor package supported on LPDE-3 that is designed to monitor other satellites and gather data on their trajectories and anomalies like changes in their orbits.[68]

Space-Based Space Surveillance System-1 (SBSS-1) (One Satellite). The SBSS-1 satellite was launched into LEO in 2010 to detect and track space objects such as satellites and orbital debris. This satellite has a seven-year life expectancy.[69]

Space Tracking and Surveillance System Advanced Technology Risk Reduction (STSS-ATR)

(One Satellite). STSS-ATR is an RDT&E satellite placed in a polar LEO on May 5, 2009, for the Missile Defense Agency (MDA) to test an alternate technology for potential application to missile defense.[70]

Space Surveillance Network (SSN) Terrestrial-Based Sensors (24 Sensors).

There are six dedicated, ground-based radar sensors that track satellites and orbital debris, including the Space Fence on Kwajalein Atoll in the South Pacific. Seven collateral radar sensors are part of this network, but their primary mission is to detect and track intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs) and to test and evaluate other systems.[71] Another 10 contributing SSN sensors controlled by other organizations or agencies provide space surveillance support upon request from the National Space Defense Center (NSDC).[72] The Space Fence radar emits a very narrow, fan-shaped beam in the north–south direction that "paints" satellites and debris from low Earth orbit as they fly through the radar fan, and it can track objects all the way out to GEO.

Offensive and Defensive Satellites and Sensors

Ascent (One Satellite). Ascent is a 12-unit (12U) miniaturized satellite (CubeSat) that was deployed to evaluate CubeSat operations in GEO.[73] Billed as a developmental SmallSat, its CubeSats likely have the ability to conduct RPO operations, potentially providing a lasting, on-orbit, offensive capability.

Tetra-1 (One Satellite). Tetra-1 is the first of a series of GEO-based SmallSats and was launched on November 1, 2022. The Tetra series is designed to host a variety of payloads and will have interesting maneuverability options[74] that will help to develop on-orbit tactics, techniques, and procedures.[75]

Energetic Charged Particle-Lite (ECP-Lite) (One-Sensor Payload). ECP-Lite is a suite of sensors packaged in a container that is less than half of a cubic foot in size and is designed to be attached to host satellites. This sensor suite detects threats that include space weather and "other" hazards that involve surface impacts, dose, and internal and surface charging.[76] This is very likely a prototype threat warning system, similar to radar warning receivers (RWR) on fighter aircraft, that will be packaged with future spaceborne systems to significantly improve the defensive capabilities of on-orbit platforms.

Catcher (One-Sensor Payload). Catcher is a sensor similar to ECP-Lite that can detect threats near the host's surrounding environment, including mechanical impact threats from the electromagnetic spectrum.[77]

Early Missile Warning/Tracking and Nuclear Detonation Detection

Space-Based Infra-Red System (SBIRS) (10 Satellites). SBIRS is an integrated constellation of satellites that was designed to deliver early missile warning and provide intercept cues for missile defenses. This surveillance network was designed to incorporate three satellites in high elliptical orbit (HEO) and eight others in GEO, each working in concert with ground-based data processing and command and control centers. Because SBIRS HEO is a retaskable orbit, these satellites can be moved to more optimal orbits/viewpoints as mission requirements dictate. Four SIBRS HEO[78] satellites are in orbit,[79] and the sixth and final satellite in this constellation, GEO-6, was launched into orbit on August 4, 2022.[80] Each of these satellites has a programmed life span of 12 years.[81]

The funding that was removed from SBIRS was shifted to a new program, Next-Generation Overhead Persistent Infrared (Next-Gen OPIR), which will include a new ground-control system. The proposed constellation will consist of five satellites, three in geosynchronous orbit and two in polar orbit.[82] Fielding of this strategically survivable constellation of missile warning satellites is scheduled to begin sometime near the end of FY 2023.[83]

Proliferated Warfighter Space Architecture (PWSA) Tranche 0–Tracking (Four Satellites). The PWSA Tranche 0 constellation will serve as a warfighter immersion/support military exercises tranche, including advanced missile tracking tests, with low-latency data connectivity, beyond-line-of-sight targeting, missile warning/missile tracking, on-orbit fusion, and multi-phenomenology ground-based sensor fusion.[84] These are the first Tracking Layer satellites with Wide Field of View (WFOV) infrared sensors. The operational constellation that follows (Tranche 1) will also have Medium Field of View (MFOV) infrared sensors that collectively will provide global, persistent detection, tracking, and queuing data for missile defense systems.

Once fully fielded, the PWSA Tranche 0 constellation of 19 transport satellites and eight tracking platforms[85] will serve as a warfighter testbed/immersion constellation that will support military

TABLE 16

Space Launches by Country

	U.S.	China	Russia	India
2010	15	15	22	1
2011	17	19	21	3
2012	12	19	14	2
2013	19	14	21	3
2014	22	16	26	5
2015	20	19	19	5
2016	26	20	13	7
2017	30	16	14	4
2018	33	38	15	7
2019	27	32	21	6
2020	38	35	12	2
2021	51	54	16	1
2022	79	62	21	4
2023	118	24	18	14
Total	**507**	**383**	**253**	**64**

NOTE: Figures for 2023 include both actual and projected launches.
SOURCE: Space Launch Schedule, https://www.spacelaunchschedule.com/ (accessed September 11, 2023).

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exercises and provide low-latency data connectivity and on-orbit fusion.[86] While it is a demonstration testbed for future tranches, the Tranche 0 constellation will no doubt be able to service ongoing operational needs well after the utility of their test function has been served.[87] The PWSA's programmed life span is unknown.

Defense Support Program (DSP) (Five Satellites). DSP is a classified constellation that was designed to detect launches of ICBMs or SLBMs against the U.S. and its allies. Its secondary missions include detection of space launch missions or nuclear weapons testing and detonations, as well as launches of shorter-range ballistic missiles. The DSP constellation uses infrared sensors to pick up the heat from missile booster plumes against the Earth's background from GEO orbits. Phase 1 placed four satellites in orbit from 1970 through 1973[88] and was followed by Phase 2, which placed six satellites in orbit from 1979–1987.[89] Phase 3 consisted of 10 DSP satellites that were launched from 1989–2007.[90]

Although Phase 3 DSP satellites have long exceeded their five-year design lives,[91] reliability has exceeded expectations. At least five[92] are still operational, providing reliable data, and are now integrated with and controlled by the SBIRS program ground station.[93]

Space Tracking and Surveillance System (STSS) (Two Satellites). Formerly known as SBIRS-Low, the two STSS satellites carry a very capable set of infrared and visible sensors for detecting and tracking ballistic missiles through all phases of their trajectory. These satellites were launched into LEO in 2009 with programmed life spans of two years.[94]

Space Test Program Satellite-6 (STPSat-6) (One Satellite). STPSat-6 hosts nine national security and science mission payloads that deliver operational Nuclear Detonation (NUDET) detection capabilities, high-bandwidth laser communications services, and new technology demonstrations in space domain awareness, weather, and NUDET detection.[95] STPSat-6 has an estimated life span of from eight–10 years.[96]

Reconnaissance and Imaging Satellites (Number Unknown). Although the history of the Air Force is steeped in these reconnaissance systems, the operational details of each constellation are classified. In the late 1990s and early 2000s, the Air Force moved to develop and field a constellation of space-based radar satellites. That program, known as Lacrosse/Onyx, launched five satellites, each carrying a synthetic aperture radar (SAR) as its prime imaging sensor. Because SAR systems can see through clouds with high resolution, they offer the potential to provide a capability from which it is hard to hide.[97]

Ground Control Network

The majority of USSF satellites are controlled by a network of 19 parabolic antennas distributed across seven locations around the world.[98] The antennas are massive, permanent fixtures, which makes them easy targets for adversaries during hostilities. If all seven locations were taken offline, it would sever our ability to communicate with a host of critical spaceborne systems. The USSF should aggressively expand the ground control network with

TABLE 17

U.S. Space Launches by Organization

Company	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Space X	2	0	1	3	6	6	8	18	21	15	28	33	61	97
Northrop Grumman	2	3	1	5	2	0	2	3	2	3	3	4	2	1
United Launch Alliance	9	12	10	11	14	12	12	8	8	5	6	5	8	12
Astra	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Rocket Lab, LTD	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Firefly Aerospace	0	0	0	0	0	0	0	0	0	0	0	0	1	2
NASA	2*	2*	0	0	0	0	0	0	0	1	0	0	1	0
Blue Origin	0	0	0	0	0	2	4	1	2	3	1	6	3	1
Virgin Orbit	0	0	0	0	0	0	0	0	0	0	0	2	2	0
Relatively	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	**15**	**17**	**12**	**19**	**22**	**20**	**26**	**30**	**33**	**27**	**38**	**51**	**79**	**118**

* United Space Alliance.
NOTE: Figures for 2023 include actual and projected launches.
SOURCE: Space Launch Schedule, "USA Launch Schedule," https://www.spacelaunchschedule.com/category/usa/ (accessed September 18, 2023).

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additional fixed and mobile parabolic antenna systems to ensure that connectively remains seamless.

All GPS satellites are controlled by the Master Control Station (MCS) at Schriever Space Force Base in Colorado and an Alternate MCS (AMCS) at Vandenberg Space Force Base in California, "both of which include the ground antenna and monitoring stations."[99]

Space Launch Capacity

The Space Force manages the National Security Space Launch (NSSL) program, a Major Defense Acquisition Program that acquires launch services from private companies to deliver national security satellites into orbit. Currently, the NSSL uses the Atlas V and Delta IV Heavy launch vehicles from United Launch Alliance (ULA) and the Falcon 9 and Falcon Heavy from SpaceX to launch national security payloads.

In 2018, the Air Force awarded three launch services agreements to space launch companies to develop their launch vehicles for a second phase of the NSSL. In 2020, the Space Force awarded two launch services procurement contracts to ULA and SpaceX, and those two vendors will provide space launch services for the Space Force through 2027.[100]

In 2010, four organizations, including NASA, were involved in launching manned and unmanned systems into space. Today, nine private American corporations are engaged in placing satellites into orbit.[101]

In 2023, U.S. companies are scheduled to launch 118 missions into space, and China and Russia are scheduled to conduct 24 and 18 launches, respectively.[102] The numbers for China and Russia are based on launch schedules published for each of those countries and are often misleading. China planned 22 launches in 2022, but it actually launched 62 missions into space, which was just behind the U.S.'s 79 space shots for that same year.[103] America is still outpacing its peers with this vital capability, but the competition appears to be gaining.

TABLE 18

U.S. Satellites in Orbit

System	Function	Satellites
GPS	Positioning, Navigation, and Timing	37
DMSP	Weather	4
Electro-Optical Infrared Weather System – G1	Weather	2
Milstar	Communications	5
AEHF	Communications	6
DSCS	Communications	6
WGS	Communications	10
Continuous Broadcast Augmenting SATCOM (CBAS)	Communications	2
Fleet Satellite Communications System (FLTSAT)	Communications	6
Ultra-Hi Freq Follow-On (UFO)	Communications	10
Mobile User Objective System (MUOS)	Communications	5
Tranche 0 Transport Proliferated Warfighter Space Architecture (PWSA)	Communications	19
SBIRS	Missile Warning	10
DSP	Missile Warning	5
Tranche 0 Tracking Proliferated Warfighter Space Architecture (PWSA)	Missile Warning	4
LPDE	Payload Support and Satellite Delivery	3
Tetra 1 – GEO	Classified	1
Ascent	Cubesat Payload Delivery	1
Space Test Program Satellite 6 (STPSat-6)	Nuclear Detonation Detection	1
GSSAP	Space Surveillance	6
Silent Barker (Space Object Tracking)	Space Surveillance	2
SBSS	Space Surveillance	1
STSS-ATR	Missile Defense and Space Tracking	1
Total		**147**

SOURCES: Heritage Foundation research using data from Gunter's Space Page, https://space.skyrocket.de (accessed September 21, 2023), and U.S. Air Force, *Air & Space Forces Magazine*, Airforce Technology, Los Angeles Air Force Base, GlobalSecurity.org, Space Development Agency, U.S. Department of Defense, *SpaceNews*, *Popular Mechanics*, Air Force Research Laboratory, and Northrop Grumman.

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Capacity

The USSF has increased the number of satellites in its portfolio from an estimated 114 satellites in 2022 to an estimated 144 in 2023, a 24 percent growth in a single year. That space-based portfolio can meet much of the communications, collection, and imagery demand placed on it by the National Command Authorities and the strategic-level intelligence requirements of the Defense Department. However, getting real-time satellite intelligence to warfighters at the operational and tactical levels is still problematic. The growth in the number of satellites in the Space Force constellation not only delivers more capability and capacity, but also provides additional resilience against a potential adversary.

The position, navigation, and timing services offered by GPS are unrivaled in both capacity and capability. With 31 operational GPS satellites in orbit and seven spaceborne (dormant) spares, the system has enough redundancy and resilience to handle losses associated with normal (not combat-related) space operations.

The current and growing DOD demands for imagery and collection are another thing entirely. The shortfall is projected to be so great that the Departments of the Air Force and Army, the National Reconnaissance Office, and other agencies have invested in and are employing the services of commercial organizations to provide collection and imagery on demand.[104]

Over the past several years, the U.S. Army has conducted a series of exercises called Project Convergence (PC), which are designed to test the capability of DOD and commercial spaceborne systems to provide the intelligence, imagery, and communications linkages for warfighters in the service's "close fight." In PC20, Army Brigade Combat Teams (BCTs), Combat Aviation Brigades (CABs), and Expeditionary Signal Battalion-Enhanced (ESB-E) units had access to 600 commercial SpaceX Starlink satellites in LEO[105] that readily enabled tactical employment.[106] As of August 27, 2023, 4,661 Starlink satellites were in orbit.[107] Systems like Starlink will help to enable the service's concept for a Multi-Domain Operations (MDO)–capable force by 2028 and an MDO-ready force by 2035.[108]

The capabilities and resilience offered by commercial systems like Starlink have been clearly demonstrated in Ukraine, where thousands of deployed Starlink Internet terminals have ensured Ukraine's internal and external connectivity with Western governments, nullifying a significant part of Russia's information campaign.[109] Starlink reportedly also has the ability to provide a very accurate PNT backup for GPS, which will become increasingly important for all of the services as the competition in space intensifies.[110]

Integrating LEO, MEO, and GEO satellite capabilities will continue to increase network resilience for the warfighter.[111] The capabilities demonstrated in the PC exercise series are similar to those sought in the Air Force's Advanced Battle Management System (ABMS) and the Navy's Overmatch C2 development programs.[112]

The USSF's ISR portfolio of satellites has grown from 15 to 19 known satellites that are dedicated to missile launch warning—a 27 percent increase over 2022. The Space Force's 10 SBIRS satellites, five DSP satellites, and four PWSA Tranche 0 satellites provide global coverage and generally excellent response times.

As noted, the current portfolio of reconnaissance satellites, while highly classified, likely meets many of the essential strategic requirements of the National Command Authority (NCA) and the Defense Department. However, Space Force capabilities fall well short of the needs of the services. The Department of the Air Force is therefore investing in and employing the services of commercial organizations to meet the on-demand collection and imagery needs of USSF customers.[113]

The Space Force's acknowledged and unacknowledged SSA satellites, coupled with six dedicated and 17 collateral and contributing ground-based sensors, help to maintain situational awareness of satellites and other objects in space. However, the limited number and inherent limitations of the sensors within the SBSS leave significant gaps in coverage. Those gaps are addressed by prediction, and every time a satellite maneuvers, "the process of initial discovery by a sensor, creation of an initial element set, and refinement of that element set needs to be repeated."[114]

Capability

Defensive systems and operations are designed to protect friendly space capabilities against kinetic anti-satellite (ASAT) weapons, high-powered lasers, laser dazzling or blinding, and high-powered microwave systems.[115]

The first challenge in defense is detecting an attack. The USSF has 14 SSA satellites that are dedicated to detecting the launch of terrestrial-based ASAT weapons. The gaps in the SSA network highlighted earlier make the timely assessment of and response to such an attack on a specific U.S. satellite difficult.

Several years ago, the Space Force fielded a terrestrial-based system called Bounty Hunter that can detect an adversary's attempts to deceive, disrupt, deny, or degrade satellite communications by monitoring electromagnetic interference across multiple frequency bands. Bounty Hunter operators can locate sources of intentional and unintentional interference and minimize them.[116] This system achieved initial operational capability (IOC) in the summer of 2020 and is a significant addition to the Space Force portfolio, but it has no known capability to detect or counter lasers. Having threat detection payloads like ECP-Lite and Catcher onboard our satellites will help to close that gap and give our systems and their operators the chance to maneuver out of the threat's path.

Cyberattacks present a different challenge to space-based systems. Like other kinetic and non-kinetic attacks, cyber intrusions can cause service disruptions, sensor interference, or the permanent loss of satellite capabilities. Additionally, an effective cyberattack could corrupt the satellite's data stream to reliant elements or systems—or even allow an adversary to seize control of a satellite. According to the Royal Institute of International Affairs, the U.S. is well behind its peer competitors in this area and should assume that its satellite constellations have already been penetrated and compromised.[117]

Defensive measures that the service can take to safeguard its spaceborne portfolio can be separated into two categories of actions: passive and active.

- Passive defense measures increase survivability through asset proliferation, placing spaceborne capabilities in different orbits to complicate an enemy's targeting problem and threat warning sensors on our assets to allow real-time threat detection and enable satellite maneuvering by an operator or artificial intelligence system.[118] The Space Force has made great strides in each of these areas.

- An active defense is actually offensive in nature and includes engagements to destroy, nullify, or reduce enemy systems that put U.S. and allied systems and capabilities at risk.

The FY 2017 Air Force budget included $158 million to develop offensive space capabilities over a period of five years, and this appears to be paying dividends.[119] The only offensive Space Force system of record in open-source literature is a mobile, terrestrial-based, counter-communications system that delivers reversable effects on hostile SATCOM systems in a given area of responsibility (AOR).[120] However, with the fielding of Ascent and Tetra-1, the Space Force appears to be building classic offensive counterspace capabilities. Both satellites can move to engage with and deliver CubeSats with RPO capabilities that attach to enemy systems and lie in wait until their payloads are activated to take those satellites offline. While unconfirmed in literature, the potential for those activities has been confirmed by senior USSF officials.

Readiness

The Space Force was born of a congressionally mandated study that included a plan for the incremental transition of operational Air Force space assets and personnel to the new service. Throughout the plan's execution, the USSF has been deliberate in its hiring and is on a path to developing a solid cadre of personnel and a strong organizational culture.

The operations assumed by the USSF to support strategic and high-end operational-level support have proceeded uninterrupted, and readiness has remained high, but those operations were primarily supportive in nature and did not include robust, nearly real-time support to tactical units. While the service is undoubtedly moving forward on credible defensive and offensive readiness, there is little evidence that it is ready for the threat envisioned by Congress when it authorized creation of the Space Force.

Scoring the U.S. Space Force

Capacity Score: Marginal

The numbers and types of Backbone and ISR assets are sufficient to support global PNT requirements and the majority of strategic-level communications, imagery, and collection requirements of the National Command Authorities and the Department of Defense. While that capacity is growing, the Space Force is not capable of meeting current—much less future—on-demand, operational, and tactical-level warfighter requirements.

As noted in the capability section, the gaps in the SBSS are covered by prediction, and operators of adversarial satellites can time their maneuvers to take advantage of those gaps.

With the fielding of WASSAT sensor payload, the capacity for the Space Force to track hostile space-based threats has improved and will continue to improve significantly. The U.S. had announced plans to build a second, strategically located Space Fence like the one on Kwajalein Atoll in Western Australia in 2021, but that site has yet to be funded.[121] Even if a second Space Fence does eventually materialize, the Space Force will still need more satellites that are dedicated to this mission.[122]

The service doubled its counterspace weapons systems' capabilities with the Ascent and Tetra-1 satellites, adding the first two known offensive systems to the Space Force portfolio. Other counterspace systems are probably being developed or, like cyber, are already in play without public announcement. Nevertheless, the USSF's current visible capacity is not sufficient to support, fight, or weather a war with a peer competitor.

Capability Score: Marginal

SDA's asset modernization plan significantly accelerated the delivery of systems to the Space Force over the past year, significantly elevating USSF capabilities. However, a majority of Backbone and ISR assets have exceeded their designed life spans, and the DAF's willingness to delay and/or defer the acquisition of replacement systems remains a legacy of that department.

The capability of Backbone and ISR satellites is marginal, but the service has narrowed gaps in SSA, defensive, and offensive capabilities. The capability score is therefore "marginal," the result of being scored "strong" in "Size of Modernization Program," "marginal" for "Age of Equipment" and "Health of Modernization Programs," and "marginal" for "Capability of Equipment."

Readiness Score: Marginal

The mission sets, space assets, and personnel that transitioned to the Space Force and those that have been assigned to support the USSF from the other services have not missed an operational beat since the Space Force stood up in 2019. Throughout that period, readiness levels have seamlessly sustained Backbone and ISR support to the NCA, DOD, Combatant Commanders, and warfighters around the world.

However, there is little evidence that the USSF has improved its readiness to provide nearly real-time support to operational and tactical levels of force operations ("marginal") or its readiness to execute defensive and offensive counterspace operations to the degree envisioned by Congress when it authorized creation of the Space Force ("weak").

Overall U.S. Space Force Score: Marginal

This is an unweighted average of the USSF's capacity score of "marginal," capability score of "marginal," and readiness score of "marginal," which is one grade higher than the service was rated in the *2023 Index of Military Strength*. The trend lines for capability and capacity are improving rapidly, and this could bode well for the service in 2024 and beyond.

U.S. Military Power: Space

	VERY WEAK	WEAK	MARGINAL	STRONG	VERY STRONG
Capacity			✓		
Capability			✓		
Readiness			✓		
OVERALL			✓		

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Navigation

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Global Positioning System (GPS) Inventory: **37** Fleet age: **13.5** Date: **1997** GPS satellites provide precise positioning, navigation, and timing (PNT) for millions of simultaneous users around the world. The current constellation of 37 satellites is comprised of Block IIR (launched from 1997–2004); IIR-M (2005–2009); IIF (2010–2016); and III/IIIF (first launch 2018) satellites with steadily increasing capabilities.	5	5	**GPS III** Timeline: **2019–TBD** GPS III is the latest upgrade to the GPS platform and incorporates more robust anti-jamming capabilities. It is interoperable with other countries' Global Navigation Satellite Systems, which adds resilience to the GPS system. **PROCUREMENT**: 7 / 12 **SPENDING** *($ millions)*: $2,026 / $5,060	5	5

Missile Warning

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Space Based Infrared System (SBIRS) Inventory: **10** Fleet age: **9** Date: **2006** An integrated constellation of 10 satellites, SBIRS is designed to deliver early missile warning and provide intercept cues for missile defenses. The satellites are retaskable, which means they can be moved to more optimum orbits and viewpoints as mission requirements dictate. The program was ended early because of cost, schedule, and performance issues.	5	5	**Next Generation Persistent Infrared (Next-Gen OPIR)** Timeline: **TBD** When the SBIRS program was ended early, its remaining funding was shifted to its follow-on program, the Next-Gen OPIR. This program's objective is to deliver resilient detection and tracking capability in a contested environment given the advances in adversary rocket propulsion technology.		
Defense Support Program (DSP) Inventory: **5** Fleet age: **34.5** Date: **1970** These satellites were designed to detect intercontinental ballistic missile and sea-launched ballistic missile launches against the U.S. and its allies. They can also detect space launch missions and nuclear weapons testing/detonations. Phase 3 satellites were launched from 1989 to 2007 and have long exceeded their designed lifetimes, but at least five are still providing reliable data and are integrated with the SBIRS program.	1	4			

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Space Surveillance

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Space Based Surveillance System (SBSS) Inventory: **1** Fleet age: **13** Date: **2010** This single satellite uses multiple types of sensors to track man-made objects and debris fields in orbit.	2	3	None		
Space Test Program Satellite-6 (STPSat-6) Inventory: **1** Fleet age: **2** Date: **2021** STPSat-6 hosts nine national security and science mission payloads that deliver operational nuclear detonation detection capabilities, high-bandwidth laser communications services, and new technology demonstrations in space domain awareness.	5	3			
Long Duration Propulsive Evolved Expendable Launch Vehicle (LPDE) Inventory: **3** Fleet age: **1** Date: **2021** These satellites provide power, pointing, telemetry, and command and control for up to six sensors payloads that remain with and are supported by the vehicle, or an equal number of deployable SmallSats to low Earth orbit (LEO); medium Earth orbit (MEO); geosynchronous orbit (GEO); or Super GEO.		5			

Missile Defense

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Space Tracking and Surveillance System Advanced Technology Risk Reduction (STSS-ATR) Inventory: **1** Fleet age: **14** Date: **2009** This research, development, test, and evaluation (RDT&E) satellite was originally launched by the Missile Defense Agency to explore different missile launch detection and early warning capabilities and technology but was transferred to the Air Force in 2011.	2	3	None		

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

SPACE FORCE SCORES

1 2 3 4 5 — Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Space Object Tracking

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Geosynchronous Space Situational Awareness Program (GSSAP) Inventory: **6** Fleet age: **5** Date: **2014** This highly classified, six-satellite constellation can accurately track and characterize objects in orbit using electro-optical and emissions sensors. Their maneuverability allows them to conduct rendezvous and proximity operations (RPO) on space objects, giving them the potential to conduct offensive operations against other nations' assets.	5	5	None		

Weather

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Defense Meteorological Satellite Program (DMSP) Inventory: **4** Fleet age: **19** Date: **1999** This three-satellite constellation was launched between 1999 and 2009 with only a five-year life expectancy, but they have continued to provide accurate meteorological data well beyond that time frame and are still in use today. However, Space Force officials have warned that the DMSP constellation will become inoperable at some point between 2023 and 2026 and that the proposed replacement system will not begin operation until 2024 at the earliest.	1	4	**Weather System Follow-on Microwave Satellite (WSF-M)** Timeline: **TBD** This next-generation weather satellite will be capable of mapping both terrestrial and space weather and is scheduled to be fielded in 2023. It covers three gaps in DOD's current weather monitoring capability: ocean surface vector winds, tropical cyclone intensity, and "energetic charged particles" in low Earth orbit.		

Communications

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Milstar Inventory: **5** Fleet age: **24.5** Date: **1994** Milstar is a satellite communications system designed in the 1980s to provide the National Command Authorities with global communications that were assured and survivable and that carried low probability of interception or detection. Designed to overcome nuclear effects and enemy jamming, this five-satellite constellation was considered the most robust and reliable DOD SATCOM system at the time of fielding.	1	3	None		

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

SPACE FORCE SCORES

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Communications (Cont.)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Advanced Extremely High Frequency System (AEHF) Inventory: **6** Fleet age: **8** Date: **2010** The AEHF constellation is the follow-on to Milstar. Each of the six satellites provides DOD with more capacity than the entire Milstar constellation provides and with five times the Milstar data rates. The system offers secure, jam-resistant communications and command and control for military ground, sea, and air assets located anywhere in the world.	5	5	None		
Defense Satellite Communications System (DSCS) Inventory: **6** Fleet age: **30.5** Date: **1982** This system of seven satellites provides nuclear-hardened, global communications with anti-jamming capabilities to the Defense Department, State Department, and National Command Authorities.	1	2			
Wideband Global SATCOM (WGS) Inventory: **10** Fleet age: **10** Date: **2007** WGS, formerly known as the Wideband Gapfiller Satellite, is a joint-service program funded by the U.S. Air Force and U.S. Army along with international partners Australia and Canada. The 10-satellite constellation uses direct broadcast satellite technology to provide command and control for U.S. and allied forces.	4	5			
Fleet Satellite Communications System (FLTSATCOM) Inventory: **6** Fleet age: **39.5** Date: **1978** This constellation of six operational satellites is used by the Navy, the Air Force. and the presidential command network. It was transferred from the Navy to the Space Force in June 2022. WGS-11 is scheduled to launch and join the constellation sometime in 2024. **Ultra-High Frequency Follow-On (UFO)** Inventory: **10** Fleet age: **24** Date: **1993** The 10-satellite UFO constellation was designed to replace FLTSATCOM and provides communications for tactical users including aircraft, ships, submarines, and ground forces. The Navy transferred this system to the Space Force in June 2022.	1	3			

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

1 2 3 4 5
Weakest ⟷ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Communications (Cont.)

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Mobile User Objective System (MUOS) Inventory: **5** Fleet age: **9** Date: **2012** This next-generation narrowband tactical satellite communications system is designed for tactical users, significantly improving ground communications even for troops in highly remote locations or buildings with no other satellite access. The Navy transferred this five-satellite constellation to the Space Force in June 2022.	4	5	None		
Continuous Broadcast Augmenting SATCOM (CBAS) Inventory: **2** Fleet age: **2.5** Date: **2018** CBAS is a satellite communications system in GEO that provides communications relay capabilities to support senior leaders and combatant commanders, augmenting existing military satcom.	5	3			

Multi-Use

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Proliferated Warfighter Space Architecture (PWSA) Tranche 0 - Transport Sep 23 Launch Inventory: **19** Fleet age: **0** Date: **2023** PWSA Tranche 0 satellites serve as a warfighter testbed/immersion constellation that will support military exercises and provide low latency data connectivity and on-orbit fusion. While this is a demonstration testbed for future tranches, the Tranche 0 constellation of 19 planned transport satellites and four planned tracking platforms will no doubt be able to serve ongoing operational needs well after their test function has been served.	5	3	None		
Proliferated Warfighter Space Architecture (PWSA) Tranche 0 - Tracking Sep 23 Launch Inventory: **4** Fleet age: **0** Date: **2023** For description, see entry for Proliferated Warfighter Space Architecture (PWSA) Tranche 0 – Transport Sep 23 Launch.					

NOTE: See page 561 for details on fleet ages, dates, timelines, and procurement spending.

1 2 3 4 5
Weakest ←→ Strongest

Procurement and Spending ■ Through FY 2023 ■ Pending

Offensive and Defensive Satellites

PLATFORM	Age Score	Capability Score	REPLACEMENT PROGRAM	Size Score	Health Score
Ascent Inventory: **1** Fleet age: **2** Date: **2021** Ascent is a 12-unit (12U) CubeSat that was deployed to evaluate CubeSat operations in GEO. It has the potential to provide a lasting, on-orbit offensive capability. **Tetra-1** Inventory: **1** Fleet age: **1** Date: **2022** Tetra-1 is the first of a series of GEO-based SmallSats that was launched on November 1, 2022. The Tetra series is designed to host a variety of payloads and will have interesting maneuverability options that will help develop on-orbit tactics, techniques, and procedures.	5	3	None		

NOTES: See Methodology for descriptions of scores. Fleet age is the average between the last year of procurement and the first year of initial operational capability. The date is when the platform achieved initial operational capability. The timeline is from the start of the platform's program to its budgetary conclusion. Spending does not include advanced procurement or research, development, test, and evaluation (RDT&E).

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