2009 Space Almanac

The US military space operation in facts and figures.

Compiled by **Tamar A. Mehuron,** Associate Editor, and the staff of *Air Force* Magazine

This almanac was compiled by *Air Force* Magazine, with assistance and information from Celinda Marsh, OMB, Science and Space Branch; researcher Joseph J. Burger; researcher Jeremy Singer; and US Strategic Command and Air Force Space Command Public Affairs Offices.

Figures that appear in this section will not always agree because of different cutoff dates, rounding, or different methods of reporting. The information is intended to illustrate trends in space activity.

Artist's conception by Erik Simonsen

Illustration not to scale

US Military Missions in Space

Space Support

Deploy, launch, and sustain military and intelligence systems in space.

Space Force Enhancement

Provide satellite command and control communications, positioning, navigation, and timing; environmental monitoring; missile warning; and intelligence-surveillance-reconnaissance to the warfighter as well as support other intelligence, civil, and commercial users.

Space Control

Ensure freedom of action in space for the US and its allies and, when directed, deny an adversary freedom of action in space.

Space Force Application

Provide capabilities for the application of combat operations in, through, and from space to influence the course and outcome of conflict.

US Space Funding

Figures in millions of constant Fiscal 2009 dollars

Year	NASA	DOD	Other	Total
1959	1,932	3,627	252	5,811
1960	3,363	4,083	313	7,759
1961	6,673	5,866	490	13,029
1962	12,822	9,261	1,420	23,503
1963	25,540	10,918	1,810	38,268
1964	34,877	11,118	1,481	47,476
1965	35,163	10,772	1,649	47,584
1966	33,686	11,233	1,423	46,343
1967	31,157	10,734	1,374	43,266
1968	27,425	11,899	1,078	40,402
1969	22,428	11,812	1,000	35,240
1970	19,692	9,316	783	29,790
1971	16,490	8,040	861	25,391
1972	15,824	7,250	687	23,761
1973	15,007	7,875	715	23,597
1974	12,060	7,719	691	20,470
1975	11,679	7,580	632	19,891
1976	12,213	7,509	637	20,359
1977	12,232	8,576	688	21,496
1978	11,973	9,048	747	21,767
1979	11,965	9,014	736	21,716
1980	12,243	10,066	605	22,913
1981	11,839	11,450	556	23,845
1982	12,345	14,916	698	27,959
1983	13,694	19,517	708	33,918
1984	14,229	21,152	819	36,200
1985	13,868	25,570	1,169	40,607
1986	14,081	27,762	937	42,780
1987	18,608	30,897	884	50,388
1988	15,165	32,216	1,350	48,732
1989	17,557	31,136	974	49,667
1990	18,906	25,763	834	45,503
1991	20,655	22,452	1,223	44,330
1992	20,289	23,092	1,226	44,607
1993	19,496	21,051	1,091	41,638
1994	18,941	19,151	920	39,012
1995	17,747	15,061	1,074	33,882
1996	17,266	15,817	1,137	34,220
1997	16,728	15,747	1,060	33,535
1998	16,285	16,335	1,110	33,729
1999	16,112	17,075	1,270	34,457
2000	15,660	16,185	1,320	33,166
2001	16,186	17,430	1,292	34,908
2002	16,610	18,848	1,432	36,891
2003	16,809	22,695	1,528	41,032
2004	16,324	21,787	1,669	39,780
2005	16,804	21,872	1,707	40,383
2006	16,839	23,621	1,759	42,219
2007	16,176	23,293	1,746	41,214
2008	16,519	24,820	1,696	43,034
Total	**$848,183**	**$790,028**	**$51,565**	**$1,648,437**

The Year in Space

July 21, 2008
Defense acquisition chief John J. Young Jr. directs DOD offices to consider building fewer Space Radar satellites and buying foreign commercial satellite radar imagery.

Aug. 29
RapidEye AG launches a five satellite imagery constellation aboard a single DNEPR-1 rocket. Pentagon officials say the RapidEye constellation is one option for meeting some of the requirements assigned to Space Radar.

Sept. 6
GeoEye-1, the highest-resolution commercial Earth-imaging satellite, enters orbit following launch from Vandenberg AFB, Calif. The National Geospatial-Intelligence Agency funded its development and procurement.

Sept. 28
The Falcon 1 rocket, seen as a key launcher of small satellites under the Operationally Responsive Space program, puts into orbit a SpaceX satellite.

Oct. 8
Air Force officials announce that Air Force Space Command will shift ICBMs to Global Strike Command, one of several steps to strengthen and consolidate the Air Force's nuclear mission.

Oct. 24
A Delta II launcher at Vandenberg boosts into orbit a Thales Alenia-Space satellite, COSMO-SkyMed 3, for civilian-military use.

Nov. 12
USAF accepts the first Space Based Infrared System HEO (Highly Elliptical Orbit) payload and ground system into operational service. The Lockheed Martin system had successfully completed trial operations, in which live data was inserted into operational networks.

Jan. 7, 2009
Boeing announces that it has reconfigured a UHF Follow-On Satellite that services a variety of military users at fixed sites and on mobile platforms to boost communications capacity by 30 percent.

Jan. 17
A United Launch Alliance Delta IV heavy rocket lofts a National Reconnaissance Office payload into orbit from Cape Canaveral AFS, Fla. It was the booster's first launch of an NRO satellite.

Feb. 10
A defunct Russian military communications satellite and an operational Iridium commercial satellite are destroyed when they collide 480 miles above Siberia, creating a wide debris field in space.

Feb. 12
Marine Corps Gen. James E. Cartwright, vice chairman of the Joint Chiefs of Staff, says that avoiding the debris from the Feb. 10 crash will likely affect US space operations.

Feb. 19
Missile Defense Agency officials announce the transfer of the Cobra Dane phased-array radar at Shemya, Alaska, to Air Force Space Command. AFSPC will maintain and operate the radar for missile defense, space surveillance, and intelligence missions.

Feb. 26
Air Force Gen. Kevin P. Chilton, commander of US Strategic Command, announces that all debris created by the US shootdown of a tumbling spy satellite in February 2008 has de-orbited.

March 24
Airmen with the 45th Space Wing, Cape Canaveral AFS, Fla., launch a Delta II booster carrying the newest GPS satellite, the GPS IIR-20(M), into orbit. The new version includes tougher encryption for military signals and a more jam-resistant signal.

April 3
An Atlas V rocket launched at Cape Canaveral puts the second Wideband Global SATCOM system into orbit. It will augment and later replace the Defense Satellite Communications System.

April 6
Defense Secretary Robert M. Gates terminates USAF's Transformational Satellite (TSAT) Communications System program. Instead, USAF will buy two additional Advanced Extremely High Frequency Satellite Communications System satellites.

April 7
The Air Force begins seeking commercial sources for the space weather data that it gets today from Defense Meteorological Satellite Program—and would have gotten in the future from the National Polar-orbiting Operational Environmental Satellite System, but which was removed from NPOESS in a 2006 restructuring.

April 9
NRO Director Scott F. Large resigns; Air Force Maj. Gen. Ellen M. Pawlikowski, deputy director of the office, takes over on an interim basis.

April 28
The Army takes delivery of its SMDC-ONE communications nano-satellites, which were developed and built in less than a year and are the first Army-bought satellites in several decades.

May 19
Air Force Research Laboratory's TacSat-3 is launched from NASA's Wallops Island, Va., launch facility and successfully placed in orbit with a Minotaur I booster.

May 21
The GPS III team successfully completes the Preliminary Design Review for the GPS IIIA spacecraft program. GPS IIIA will deliver enhanced Earth coverage and a new civil signal compatible with Europe's Galileo program. Plans call for a constellation of 12 satellites with initial launch in 2014.

June 2
USAF awards Lockheed Martin a $1.5 billion contract for key SBIRS components, including the third highly elliptical orbit (HEO-3) payload, the third geosynchronous orbit (GEO-3) satellite, and ground modifications. The system will provide early warning of missile launches, battlespace awareness, and technical intelligence. The system is designed to replace the Defense Support Program.

June 12
Retired Air Force Gen. Bruce Carlson, who had served as commander of Air Force Materiel Command before retiring from active duty on Jan. 1, is tapped to replace Large as NRO director.

Space and Missile Badges

Space Badge

Space/Missile Badge

Air Force Astronaut

Missile Badge

Missile Badge With Operations Designator

Air Force Space Command, Peterson AFB, Colo.

(As of July 1, 2009)

Commander
Gen. C. Robert Kehler

Vice Commander
Maj. Gen. Thomas F. Deppe

Command CMSgt.
CMSgt. Richard T. Small

14th Air Force
Vandenberg AFB, Calif.
Commander
Lt. Gen. Larry D. James

21st Space Wing
Peterson AFB, Colo.
Col. John W. Raymond

30th Space Wing
Vandenberg AFB, Calif.
Col. David J. Buck

45th Space Wing
Patrick AFB, Fla.
Brig. Gen. Edward L. Bolton

50th Space Wing
Schriever AFB, Colo.
Col. Cary C. Chun

460th Space Wing
Buckley AFB, Colo.
Col. Donald McGee Jr.

Space & Missile Systems Center
Los Angeles AFB, Calif.
Commander
Lt. Gen. John T. Sheridan

GPS Wing
Col. David W. Madden

MilSatCom
Systems Wing
Brig. Gen. Samuel
A. Greaves

Space Development
& Test Wing (Kirtland
AFB, N.M.)
Col. Burke E. Wilson

Space Innovation & Development Center
Schriever AFB, Colo.
Commander
Col. Robert F. Wright Jr.

Launch and Range
Systems Wing
Col. Gary N. Henry

Space Based Infrared
Systems Wing
Col. Roger W. Teague

Space Superiority
Systems Wing
Col. Michael D. Taylor

20th Air Force
F. E. Warren AFB, Wyo.
Commander
Maj. Gen. Roger W. Burg

90th Missile Wing
F. E. Warren AFB, Wyo.
Col. Michael J. Morgan

91st Missile Wing
Minot AFB, N.D.
Col. Christopher B. Ayres

341st Missile Wing
Malmstrom AFB, Mont.
Col. Michael E. Fortney

Hq. Air Force Space Command A-Staff

A1 Personnel
Col. William E. Hampton

A2 Intelligence
Col. Karen A. Cleary

A3 Operations
Brig. Gen. Tod D. Wolters

A4/7 Logistics
Mary Christine Puckett

A5 Requirements
Brig. Gen. John E. Hyten

A6 Communications Systems
Brig. Gen. David B. Warner

A8/9 Programs
Brig. Gen. Jack Weinstein

Space Leaders

(As of June 30, 2009. A = Acting)

US Space Command

Gen. Robert T. Herres	Sept. 23, 1985	Feb. 5, 1987
Gen. John L. Piotrowski	Feb. 6, 1987	March 30, 1990
Gen. Donald J. Kutyna	April 1, 1990	June 30, 1992
Gen. Charles A. Horner	June 30, 1992	Sept. 12, 1994
Gen. Joseph W. Ashy	Sept. 13, 1994	Aug. 26, 1996
Gen. Howell M. Estes III	Aug. 27, 1996	Aug. 13, 1998
Gen. Richard B. Myers	Aug. 14, 1998	Feb. 22, 2000
Gen. Ralph E. Eberhart	Feb. 22, 2000	Oct. 1, 2002

US Strategic Command

Adm. James O. Ellis Jr.	Oct. 1, 2002	July 9, 2004
Gen. James E. Cartwright, USMC	July 9, 2004	Aug. 10, 2007
Lt. Gen. C. Robert Kehler, USAF (A)	Aug. 10, 2007	Oct. 3, 2007
Gen. Kevin P. Chilton, USAF	Oct. 3, 2007	

US Space Command was inactivated Oct. 1, 2002, and its mission transferred to US Strategic Command.

Air Force Space Command

Gen. James V. Hartinger	Sept. 1, 1982	July 30, 1984
Gen. Robert T. Herres	July 30, 1984	Oct. 1, 1986
Maj. Gen. Maurice C. Padden	Oct. 1, 1986	Oct. 29, 1987
Lt. Gen. Donald J. Kutyna	Oct. 29, 1987	March 29, 1990
Lt. Gen. Thomas S. Moorman Jr.	March 29, 1990	March 23, 1992
Gen. Donald J. Kutyna	March 23, 1992	June 30, 1992
Gen. Charles A. Horner	June 30, 1992	Sept. 13, 1994
Gen. Joseph W. Ashy	Sept. 13, 1994	Aug. 26, 1996
Gen. Howell M. Estes III	Aug. 26, 1996	Aug. 14, 1998
Gen. Richard B. Myers	Aug. 14, 1998	Feb. 22, 2000
Gen. Ralph E. Eberhart	Feb. 22, 2000	April 19, 2002
Gen. Lance W. Lord	April 19, 2002	March 3, 2006
Lt. Gen. Frank G. Klotz (A)	March 3, 2006	June 26, 2006
Gen. Kevin P. Chilton	June 26, 2006	Oct. 3, 2007
Lt. Gen. Michael A. Hamel (A)	Oct. 3, 2007	Oct. 12, 2007
Gen. C. Robert Kehler	Oct. 12, 2007	

Army Space & Missile Defense Command/ Army Forces Strategic Command

Lt. Gen. John F. Wall	July 1, 1985	May 24, 1988
Brig. Gen. R. L. Stewart (A)	May 24, 1988	July 11, 1988
Lt. Gen. Robert D. Hammond	July 11, 1988	June 30, 1992
Brig. Gen. W. J. Schumacher (A)	June 30, 1992	July 31, 1992
Lt. Gen. Donald M. Lionetti	Aug. 24, 1992	Sept. 6, 1994
Lt. Gen. Jay M. Garner	Sept. 6, 1994	Oct. 7, 1996
Lt. Gen. Edward G. Anderson III	Oct. 7, 1996	Aug. 6, 1998
Col. Stephen W. Flohr (A)	Aug. 6, 1998	Oct. 1, 1998
Lt. Gen. John Costello	Oct. 1, 1998	March 28, 2001
Brig. Gen. J. M. Urias (A)	March 28, 2001	April 30, 2001
Lt. Gen. J. M. Cosumano Jr.	April 30, 2001	Dec. 16, 2003
Lt. Gen. Larry J. Dodgen	Dec. 16, 2003	Dec. 18, 2006
Lt. Gen. Kevin T. Campbell	Dec. 18, 2006	

Army Space and Missile Defense Command was the Army Strategic Defense Command until August 1992 and the Army Space and Strategic Defense Command until October 1997.

National Reconnaissance Office

Joseph V. Charyk	Sept. 6, 1961	March 1, 1963
Brockway McMillan	March 1, 1963	Oct. 1, 1965
Alexander H. Flax	Oct. 1, 1965	March 11, 1969
John L. McLucas	March 17, 1969	Dec. 20, 1973
James W. Plummer	Dec. 21, 1973	June 28, 1976
Thomas C. Reed	Aug. 9, 1976	April 7, 1977
Charles W. Cook (A)	April 7, 1977	Aug. 3, 1977
Hans Mark	Aug. 3, 1977	Oct. 8, 1979
Robert J. Hermann	Oct. 8, 1979	Aug. 2, 1981
Edward C. Aldridge Jr.	Aug. 3, 1981	Dec. 16, 1988
Martin C. Faga	Sept. 26, 1989	March 5, 1993
Jimmie D. Hill (A)	March 5, 1993	May 19, 1994
Jeffrey K. Harris	May 19, 1994	Feb. 26, 1996
Keith R. Hall (A)	Feb. 27, 1996	March 27, 1997
Keith R. Hall	March 28, 1997	Dec. 13, 2001
Peter B. Teets	Dec. 13, 2001	March 25, 2005
Dennis D. Fitzgerald (A)	March 25, 2005	July 22, 2005
Donald M. Kerr	July 22, 2005	Oct. 8, 2007
Scott F. Large (A)	Oct. 9, 2007	Oct. 18, 2007
Scott F. Large	Oct. 19, 2007	April 18, 2009
Betty J. Sapp (A)	April 18, 2009	July 13, 2009
Bruce Carlson	July 13, 2009	

Naval Space Command

RAdm. Richard H. Truly	Oct. 1, 1983	Feb. 28, 1986
Col. R. L. Phillips, USMC (A)	March 1, 1986	April 30, 1986
RAdm. D. Bruce Cargill	April 30, 1986	Oct. 24, 1986
RAdm. Richard C. Macke	Oct. 24, 1986	March 21, 1988
RAdm. David E. Frost	March 21, 1988	April 2, 1990
Col. C. R. Geiger, USMC (A)	April 2, 1990	May 31, 1990
RAdm. L. E. Allen Jr.	May 31, 1990	Aug. 12, 1991
RAdm. Herbert A. Browne Jr.	Aug. 12, 1991	Oct. 28, 1993
RAdm. Leonard N. Oden	Oct. 28, 1993	Jan. 31, 1994
RAdm. Lyle G. Bien	Jan. 31, 1994	Dec. 13, 1994
RAdm. Phillip S. Anselmo	Dec. 13, 1994	April 18, 1995
RAdm. Katharine L. Laughton	April 18, 1995	Feb. 28, 1997
RAdm. Patrick D. Moneymaker	Feb. 28, 1997	Sept. 10, 1998
Col. M. M. Henderson, USMC (A)	Sept. 10, 1998	Oct. 1, 1998
RAdm. Thomas E. Zelibor	Oct. 1, 1998	June 8, 2000
RAdm. J. J. Quinn	June 8, 2000	March 31, 2001
RAdm. Richard J. Mauldin	March 31, 2001	Dec. 10, 2001
RAdm. John P. Cryer	Dec. 10, 2001	July 11, 2002

Naval Space Command on July 11, 2002 ceased functioning as the Navy's primary space component. Its functions were transferred to the Naval Network Warfare Command.

Naval Network Warfare Command

VAdm. Richard Mayo	July 11, 2002	March 26, 2004
VAdm. James D. McArthur Jr.	March 26, 2004	June 15, 2007
VAdm. H. Denby Starling II	June 15, 2007	

Some Milestones in Military Space

March 22, 1946. JPL-Ordnance WAC, first US rocket to leave Earth's atmosphere, reaches 50-mile height after launch from White Sands Proving Ground, N.M.

July 1, 1954. USAF establishes space-oriented Western Development Division in California under Brig. Gen. Bernard A. Schriever.

Oct. 4, 1957. USSR launches Sputnik 1, first man-made satellite, into Earth orbit.

Jan. 31, 1958. US launches its first satellite, Explorer 1.

Dec. 18, 1958. Project Score spacecraft conducts first US active communication from space.

Aug. 7, 1959. Explorer 6 spacecraft transmits first television pictures from space.

April 1, 1960. US launches TIROS 1, world's first meteorological satellite, from Cape Canaveral, Fla.

April 13, 1960. Transit 1B becomes first US navigation satellite in space.

May 24, 1960. MIDAS 2 becomes the first early warning satellite in orbit.

June 22, 1960. US launches Galactic Radiation and Background (GRAB) satellite, the nation's first successful reconnaissance spacecraft. It collects Elint from Soviet air defense radars.

Aug. 18, 1960. Discoverer/Corona satellite takes first-ever image of Soviet territory snapped from space.

March 6, 1961. Secretary of Defense Robert S. McNamara formally assigns to USAF the responsibility for development of military space systems.

Oct. 17, 1963. Vela Hotel satellite performs first space-based detection of nuclear explosion.

June 18, 1965. USAF accepts Titan III, its first vehicle specifically designed and developed as a military space booster.

Oct. 20, 1968. Soviet Kosmos 249 spacecraft carries out first co-orbital anti-satellite test, exploding Kosmos 248 target satellite into cloud of debris.

Feb. 22, 1978. Atlas booster launches into orbit the first test vehicle of the Navstar GPS constellation.

Sept. 1, 1982. Air Force establishes Space Command (later, Air Force Space Command) in Colorado Springs, Colo.

Sept. 13, 1985. F-15-launched ASM-135A ASAT missile destroys a target satellite orbiting at a speed of 17,500 mph some 290 miles above Earth.

Jan. 11, 2007. Chinese ASAT weapon destroys orbiting Chinese satellite, making China only the third nation (after the United States and Russia) to carry out such a strike.

Major Military Commands With Space Functions

The Unified Command

US Strategic Command

Headquarters: Offutt AFB, Neb.
Established: Oct. 1, 2002
Cmdr.: Gen. Kevin P. Chilton, USAF

MISSIONS

Deter attacks on US vital interests and defend the nation should deterrence fail; lead, plan, and execute strategic deterrence operations
Ensure US freedom of action in space and cyberspace
Deliver integrated kinetic and nonkinetic effects in support of US joint force commanders
Synchronize global missile defense plans and operations and regional combating of weapons of mass destruction plans
Plan, integrate, and coordinate intelligence-surveillance-reconnaissance in support of strategic and global operations as directed
Advocate for capabilities as assigned

The Service Components

Air Force Space Command

Headquarters: Peterson AFB, Colo.
Established: Sept. 1, 1982
Cmdr.: Gen. C. Robert Kehler

MISSIONS

Defend the US through control and exploitation of space
Provide strategic deterrence by operating, testing, and maintaining ICBM forces for STRATCOM
Operate and employ space forces for strategic and tactical missile warning, battlespace characterization, environmental monitoring, satellite communications, precision navigation and timing, spacelift, and space control
Acquire, launch, and sustain space systems for USAF and DOD
Develop tactics, techniques, and procedures to integrate space capabilities with air, land, and sea forces
Develop space professionals

AFSPC will transfer control and operation of ICBM forces to Global Strike Command in fall 2009.

Naval Network Warfare Command

Headquarters: Norfolk, Va.
Established: July 11, 2002
Cmdr.: Vice Adm. H. Denby Starling II

MISSIONS

Deliver integrated cyber mission capabilities in information operations, intelligence, network operations, and space that enable warfighters across the full range of military operations
Provide highly trained forces, interoperable and well-maintained equipment, and clear processes and governance

US Army Space & Missile Defense Command/Army Forces Strategic Command

Headquarters: Redstone Arsenal, Ala.
Established: Oct. 1, 1997
Cmdr.: Lt. Gen. Kevin T. Campbell

MISSIONS

Conduct space and missile defense operations and provide planning, integration, control, and coordination of Army forces and capabilities in support of US Strategic Command missions
Serve as Army's specified proponent for space, high-altitude, and ground-based midcourse missile defense
Serve as Army's operational integrator for global missile defense
Conduct space- and missile-related R&D for Army Title 10 responsibilities

Major US Agencies With Roles in Space

Central Intelligence Agency

Headquarters: McLean, Va.
Established: 1947
Director: Leon E. Panetta

Mission

Provide national security intelligence to senior US policymakers

Direct Space Role

Support the National Reconnaissance Office in designing, building, and operating satellite reconnaissance systems

National Geospatial-Intelligence Agency

Headquarters: Bethesda, Md.
Established: Nov. 24, 2003
Director: Vice Adm. Robert B. Murrett

Mission

Provide geospatial intelligence (analysis and depiction of Earth's physical features and geographic references) to aid national security operations

Formerly National Imagery and Mapping Agency (NIMA).

National Reconnaissance Office

Headquarters: Chantilly, Va.
Established: September 1961
Director: Bruce Carlson

Mission

Engage in the research and development, acquisition, launch, and operation of overhead reconnaissance systems necessary to meet the needs of the Intelligence Community and DOD
Conduct other activities as directed by the Secretary of Defense and the Director of National Intelligence

National Security Agency

Headquarters: Ft. Meade, Md.
Established: November 1952
Director: Lt. Gen. Keith B. Alexander, USA

Mission

Protect US communications
Produce foreign signals intelligence

US Military Payloads by Mission, 1958-2008

(Orbital only)

Applications	**409**
Communications	*127*
Weather	*48*
Navigation	*100*
Launch vehicle/spacecraft tests	*6*
Other military	*128*
Weapons-Related Activities	**47**
SDI tests	*11*
Anti-satellite targets	*2*
Anti-satellite interceptors	*34*
Reconnaissance	**445**
Photographic/radar imaging	*256*
Electronic intelligence	*56*
Ocean surveillance	*48*
Nuclear detection	*12*
Radar calibration	*37*
Early warning	*36*
Total	901

US Satellites Placed in Orbit or Deep Space

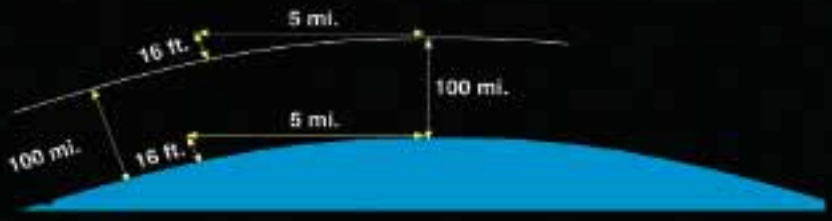
(As of Dec. 31, 2008)

Year	Military	Civil*	Total
1958	0	7	7
1959	6	5	11
1960	12	5	17
1961	20	12	32
1962	35	20	55
1963	33	22	55
1964	44	25	69
1965	49	39	88
1966	52	47	99
1967	51	34	85
1968	35	26	61
1969	32	27	59
1970	23	8	31
1971	26	18	44
1972	18	14	32
1973	14	10	24
1974	11	8	19
1975	12	16	28
1976	17	12	29
1977	14	5	19
1978	16	17	33
1979	10	7	17
1980	12	4	16
1981	7	10	17
1982	8	9	17
1983	16	12	28
1984	17	16	33
1985	13	17	30
1986	7	4	11
1987	10	1	11
1988	11	9	20
1989	15	9	24
1990	22	17	39
1991	22	13	35
1992	12	18	30
1993	12	18	30
1994	18	18	36
1995	15	23	38
1996	16	22	38
1997	9	81	90
1998	7	87	94
1999	8	74	82
2000	15	36	51
2001	8	24	32
2002	2	25	27
2003	12	14	26
2004	5	11	16
2005	6	14	20
2006	16	21	37
2007	13	31	44
2008	5	22	27
Total	**869**	**1,044**	**1,913**

*Includes some military payloads.

Orbits

Orbits result from the mutual attraction of any two bodies with a force proportional to the product of their individual masses and inversely proportional to the square of the distance between them. The curvature of the Earth, on average, drops 16 feet below the horizontal over a distance of about five miles. A spacecraft circling above would "fall" that same amount over the same distance. It travels five miles in one second if gravitational pull equals one G. Therefore, spacecraft velocity of five miles per second (18,000 mph) produces perpetual orbit at sea level, unless the spacecraft's flight is upset by perturbations, such as solar wind or mechanical anomalies.

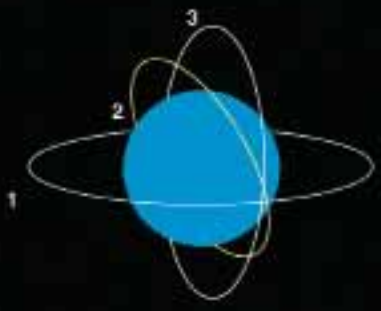


Orbital Altitude

LEO Low Earth orbit
MEO Medium Earth orbit
GEO Geosynchronous Earth orbit
HEO High Earth orbit

Orbital Inclinations

1 Equatorial
2 Sun synchronous
3 Polar



Geosynchronous Transfer Orbit

It is common procedure to pick an initial "parking" orbit, usually at LEO, then boost payloads to higher altitude. Engines are fired first (at perigee) to reach the apogee of an elliptical transfer orbit and then are fired again to put the spacecraft into a circular orbit at that higher altitude.

Illustrations are not drawn to scale.

US Military/Civil Launches

(As of Dec. 31, 2008)

Year	Military	Civil	Total	Year	Military	Civil	Total	Year	Military	Civil	Total	Year	Military	Civil	Total
1958	0	7	7	1971	16	16	32	1984	11	11	22	1997	8	29	37
1959	6	5	11	1972	14	17	31	1985	4	13	17	1998	5	29	34
1960	11	5	16	1973	11	12	23	1986	4	2	6	1999	7	23	30
1961	19	10	29	1974	8	16	24	1987	6	2	8	2000	11	17	28
1962	32	20	52	1975	9	19	28	1988	8	4	12	2001	7	14	21
1963	25	13	38	1976	11	15	26	1989	11	7	18	2002	1	16	17
1964	33	24	57	1977	10	14	24	1990	11	16	27	2003	11	12	23
1965	34	29	63	1978	14	18	32	1991	6	12	18	2004	5	11	16
1966	35	38	73	1979	8	8	16	1992	11	17	28	2005	6	6	12
1967	29	29	58	1980	8	5	13	1993	12	11	23	2006	7	10	17
1968	23	22	45	1981	7	11	18	1994	11	15	26	2007	8	10	18
1969	17	23	40	1982	6	12	18	1995	9	18	27	2008	4	12	16
1970	18	11	29	1983	8	14	22	1996	11	22	33				
												Total	**607**	**752**	**1,359**

Data changes in prior years reflect recategorization from civil to military launches.

What's Up There

As of Dec. 31, 2008

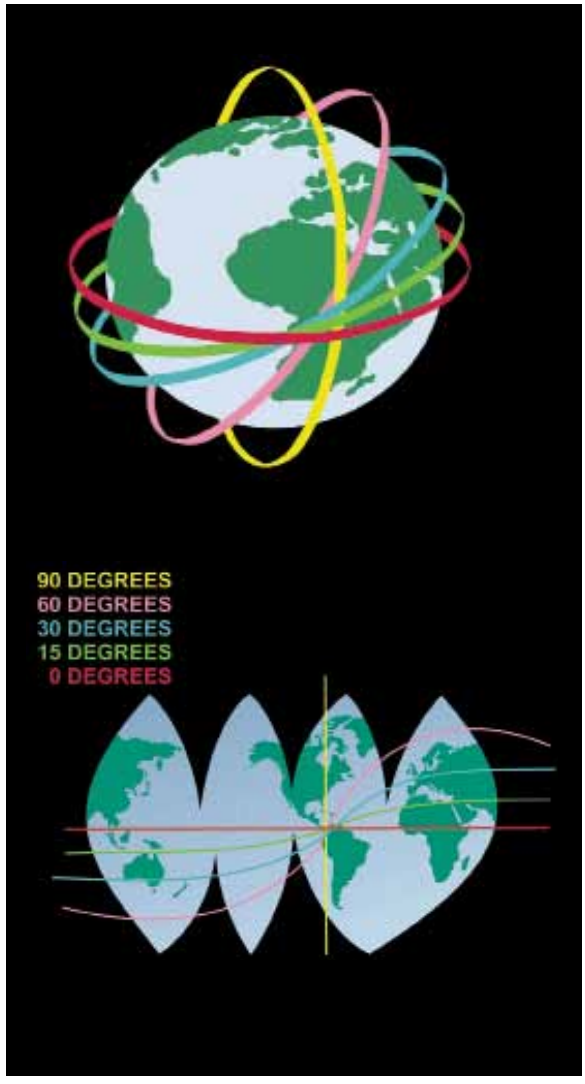
Country Organization	Payloads in Orbit: Satellites	Payloads in Orbit: Space Probes	Debris	Total
US	1,003	61	2,590	3,654
Russia*	1,379	35	2,104	3,518
People's Republic of China	78	1	2,650	2,729
France	49	0	219	268
Japan	105	10	32	147
India	36	1	98	135
European Space Agency	38	6	30	74
Intl. Telecom Sat. Org.	65	0	0	65
CHBZ	3	0	59	62
Globalstar	60	0	0	60
Germany	33	2	0	35
Orbcomm	35	0	0	35
Canada	29	0	2	31
European Telecom Sat. Org.	28	0	0	28
United Kingdom	26	0	0	26
Luxembourg	16	0	0	16
Italy	15	0	0	15
Saudi Arabia	12	0	0	12
Brazil	12	0	0	12
Int. Maritime Sat. Org	12	0	0	12
Australia	11	0	0	11
Sweden	11	0	0	11
Argentina	10	0	0	10
Indonesia	10	0	0	10
South Korea	10	0	0	10
Arab Sat. Comm. Org	9	0	0	9
Israel	9	0	0	9
Spain	9	0	0	9
NATO	8	0	0	8
Taiwan	8	0	0	8
Mexico	7	0	0	7
Thailand	7	0	0	7
Netherlands	6	0	0	6
Turkey	6	0	0	6
Czech Republic	5	0	0	5
International Space Station	1	3	2	6
Other**	47	0	3	50
Total	**3,208**	**119**	**7,789**	**11,116**

* Russia includes Commonwealth of Independent States (CIS) and former Soviet Union.

** Other refers to countries or organizations that have placed fewer than five objects in space.

Satellite Inclination

Inclination is the angle between the Earth's equatorial plane and a satellite's orbital plane. A satellite at the wrong inclination—passing over the wrong spot on Earth—may hinder its ability to perform its mission.

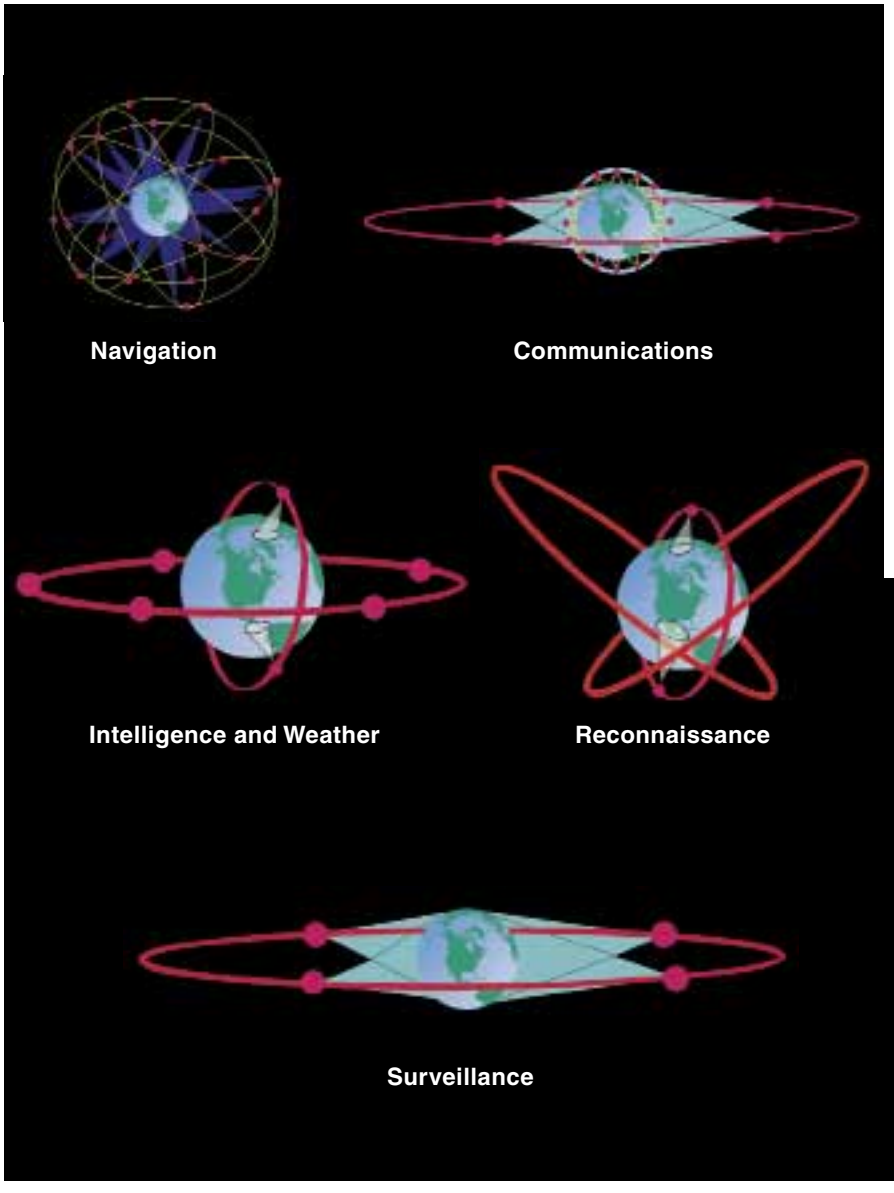


DOD image

AFSPC Squadrons by Mission Type

(As of Sept. 30, 2008)

Component	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08
Active force										
ICBM	14	14	14	14	11	11	10	10	10	10
Space operations	10	8	8	8	8	9	8	8	7	7
Space communications	1	1	1	0	0	6	7	7	6	5
Space warning	8	7	7	8	8	6	6	6	6	7
Space surveillance	6	6	4	3	3	3	0	0	0	0
Space launch	5	3	3	3	4	4	3	3	3	3
Range	2	2	2	2	2	2	2	2	2	3
Space control and tactics	1	2	3	3	3	3	5	6	6	4
Space aggressor	0	0	0	0	1	1	1	1	0	0
Total active force	**47**	**43**	**42**	**41**	**40**	**45**	**42**	**43**	**40**	**39**
Reserve forces										
ANG										
Space operations	0	0	0	1	1	3	4	3	1	2
Space warning	0	0	0	1	1	1	2	1	2	2
AFRC										
Space operations	3	3	4	4	4	4	4	4	4	4
Space warning	1	1	1	1	1	1	1	1	1	1
Space aggressor	0	0	0	0	0	1	1	1	1	1
Total reserve forces	**4**	**4**	**5**	**7**	**7**	**10**	**10**	**10**	**9**	**10**
Total all components	51	47	47	48	47	55	54	53	49	49



DOD image

US Manned Spaceflights

Year	Flights	Persons
1961	2	2
1962	3	3
1963	1	1
1964	0	0
1965	5	10
1966	5	10
1967	0	0
1968	2	6
1969	4	12
1970	1	3
1971	2	6
1972	2	6
1973	3	9
1974	0	0
1975	1	3
1976	0	0
1977	0	0
1978	0	0
1979	0	0
1980	0	0
1981	2	4
1982	3	8
1983	4	20
1984	5	28
1985	9	58
1986	1	7
1987	0	0
1988	2	10
1989	5	25
1990	6	32
1991	6	35
1992	8	53
1993	7	42
1994	7	42
1995	7	42
1996	7	43
1997	8	53
1998	5	33
1999	3	19
2000	5	32
2001	6	38
2002	5	34
2003	1	7
2004	0	0
2005	1	7
2006	3	20
2007	3	21
2008	4	29
Total	154	813

The Constellations

Multiple satellites working in groups to perform a single mission can provide greater coverage than a single satellite, enabling global coverage or increasing timeliness of coverage.

Navigation constellations provide simultaneous signals from multiple satellites to a location on the ground.

Communications constellations ensure at least one satellite is in line of sight of both ends of the communications link.

Weather and **reconnaissance** constellations generally contain both high and low altitude systems.

Some **surveillance** systems need continuous access to areas of interest, calling for high-altitude, long dwell-time orbits.

Major US Launchers in US Military Use

Atlas V
Function: lift medium to heavy weights.
Variants: 400 and 500 series.
First launch: Aug. 21, 2002.
Launch site: Cape Canaveral AFS, Fla.; Vandenberg AFB, Calif.
Contractor: Lockheed Martin.
Stages: two.
Propulsion: (400 and 500 series) stage 1: one RD AMCROSS LLC RD-180 engine with two chambers, 860,200 lb thrust; stage 2: Centaur, one or two Pratt & Whitney RL10A-4-2 engines, 16,500-22,300 lb thrust. Strap-on solid rocket boosters, up to three (400), up to five (500).
Dimensions: (stage 1) length 106.2 ft, max body diameter 12.5 ft; (stage 2) length 41.6 ft, max body diameter 10 ft.
Weight: 741,061-1.2 million lb.
Payload: (400 series) 27,558 lb to LEO, 10,913-17,196 to GTO; (500 series) 22,707-45,238 lb to LEO, 8,752-19,180 lb to GTO. (500 series supports 16.5 ft diameter payload fairing.)

Delta II
Function: lift medium weights.
First launch: Feb. 14, 1989.
Launch site: CCAFS; VAFB.
Contractor: Boeing.
Stages: up to three.
Propulsion: stage 1 (Rocketdyne RS-27A), 237,000 lb thrust; stage 2 (Aerojet AJ10-118K), 9,753 lb thrust; stage 3 (Thiokol STAR 48B solid rocket motor), 14,920 lb thrust; nine strap-on SRMs (Alliant Techsystems), 100,270 lb thrust.
Dimensions: length 125.2 ft, max body diameter 8 ft.
Weight: 511,190 lb.
Payload: 5,960-13,440 lb to LEO.

Delta IV
Function: lift medium to heavy weights.
Variants: Medium, Medium-Plus, and Heavy.
First launch: Nov. 20, 2002.
Launch site: CCAFS; VAFB.
Contractor: Boeing.
Stages: two.
Propulsion: stage 1, Rocketdyne RS-68 (Heavy, two additional core engines), 650,000 lb thrust; stage 2 (Medium), P&W RL10B-2, 24,750 lb thrust.
Dimensions: (core booster, all versions) length 125 ft, max body diameter 16.7 ft.
Weight: (Medium) 64,719 lb; (heavy) 196,688 lb.
Payload: 20,170-49,740 lb to LEO; 9,480-28,620 lb to GTO. (Heavy supports 16.6 ft diameter payload fairing.)

Minotaur I
Function: lift low weights.
First launch: January 2000.
Launch site: CCAFS; Kodiak Launch Complex, Alaska; VAFB; Wallops Island, Va.
Contractor: Orbital Sciences.
Stages: four
Propulsion: stage 1 and stage 2: Minuteman rocket motors (reusing motors decommissioned as a result of arms reduction treaties); stages 3 and 4 shared with Pegasus XL and Taurus XL commercial SLVs.
Dimensions: length 62.9 ft, max body diameter 5.5 ft.
Weight: N/A
Payload max: 1,278 lb to LEO.

Pegasus
Function: lift low weights.
Variants: Standard and XL.
First launch: (Standard) April 5, 1990; (XL) June 27, 1994.
Launch site: dropped from L-1011 aircraft.
Contractor: Orbital Sciences, Alliant.
Stages: three.
Propulsion: (XL) (all Alliant Techsystems) stage 1, 109,400 lb thrust; stage 2, 27,600 lb thrust; stage 3, 7,800 lb thrust.
Dimensions: length 49 ft, wingspan 22 ft, diameter 4.17 ft.
Weight: 42,000 lb.
Payload max: (Standard) 850 lb to LEO; (XL) 1,050 lb to GEO.

Space Shuttle
Function: lift heavy weights.
First launch: April 12, 1981.
Launch site: John F. Kennedy Space Center, Fla.
Contractor: Boeing (launch).
Stages: delta-winged orbiter.
Propulsion: three main engines, 394,000 lb thrust; two SRMs, 3.3 million lb thrust.
Dimensions: system length 184 ft; span 78 ft.
Weight: 4.5 million lb (gross).
Payload max: 55,000 lb to LEO.

Taurus
Function: lift low weights.
Variants: Standard and XL.
First launch: March 13, 1994.
Launch site: CCAFS; Kodiak Launch Complex, Alaska; VAFB; Wallops Island, Va.
Contractor: Orbital Sciences.
Stages: four.
Propulsion: Castor 120 SRM, 495,400 lb thrust; stage 1, 109,140 lb thrust; stage 2, 26,900 lb thrust; stage 3, 7,200 lb thrust. (Stages 1-3, Alliant Techsystems)
Dimensions: length 89 ft, max body diameter 7.6 ft.
Weight: 170,000 lb max.
Payload max: 3,000 lb to LEO.

USAF photo

Atlas V

USAF photo

Delta II

Orbital Sciences Corp. photo

Pegasus

Orbital Sciences Corp. photo

Taurus

USAF photo

Delta IV

Orbital Sciences Corp. photo

Minotaur I

USAF photo

Space Shuttle

Major Military Satellite Systems

Advanced Extremely High Frequency Satellite Communications System
Common name: AEHF
In brief: successor to Milstar, AEHF will provide assured strategic/tactical, worldwide C2 communications with at least 10 times the capacity of Milstar II but in a smaller package.
Function: EHF communications.
Operator: MILSATCOM JPO (acquisition); AFSPC.
First launch: late 2010.
On orbit: four, planned.
Orbit altitude: 22,000+ miles.

Defense Meteorological Satellite Program
Common name: DMSP
In brief: satellites that collect air, land, sea, and space environmental data to support worldwide strategic and tactical military operations. Operational control transferred to NOAA in 1998; backup operation center at Schriever AFB, Colo., manned by Air Force Reserve Command personnel.
Function: environmental monitoring.
Operator: NPOESS Integrated Program Office.
First launch: Aug. 23, 1962.
On orbit: two (primary).
Orbit altitude: approx 527 miles.

Defense Satellite Communications System III
Common name: DSCS
In brief: nuclear-hardened and jam-resistant spacecraft used to transmit high-priority C2 messages to battlefield commanders.
Function: SHF communications.
Operator: AFSPC.
First launch: October 1982.
On orbit: five (primary).
Orbit altitude: 22,000+ miles.

Defense Support Program
Common name: DSP
In brief: early warning spacecraft whose infrared sensors detect heat generated by a missile or booster plume.
Function: strategic and tactical missile launch detection.
Operator: AFSPC.
First launch: November 1970.
On orbit: classified.
Orbit altitude: 22,000+ miles.

Enhanced Polar System
Common name: EPS
In brief: next generation polar communications to replace interim polar system (see Interim Polar System, next column), which provides polar communications capability required by aircraft, submarines, and other forces operating in the high northern latitudes. Pre-acquisition, system definition, and risk reduction efforts started in Fiscal 2006.
Function: EHF polar communications.
Operator: MILSATCOM JPO (acquisition); AFSPC.
First launch: availability 2013.
On orbit: two, planned.
Orbit altitude: 22,300+ miles.

Global Broadcast System
Common name: GBS
In brief: wideband communications program, initially using leased commercial satellites, then military systems, to provide digital multimedia data directly to theater warfighters.
Function: high-bandwidth data imagery and video.
Operator: Navy.
First launch: March 1998 (Phase 2 payload on UHF Follow-On). Continued on Wideband Global SATCOM (WGS) in 2008.
On orbit: two.
Orbit altitude: 23,230 miles.

Global Positioning System
Common name: GPS
In brief: constellation of satellites used by military and civilians to determine a precise location and time anywhere on Earth. Block IIR began replacing older GPS spacecraft in mid-1997; first modified Block IIR-M with military signal (M-code) on two channels launched in 2005. Next generation Block IIF with extended design life, faster processors, and new civil signal on third frequency launches in 2009. Generation after next GPS III with advanced anti-jam and higher quality data is slated for initial launch in 2014.
Function: worldwide positioning, navigation, and precise time transfer.
Operator: AFSPC.
First launch: Feb. 22, 1978 (Block I).
On orbit: 30.
Orbit altitude: 10,988 miles.

Interim Polar System
Common name: IPS
In brief: USAF deployed a modified EHF payload on a host polar-orbiting satellite to provide an interim solution to ensure warfighters have protected polar communications capability. Polar 3 launched in 2007.
Function: EHF polar communications.
Operator: Navy.
First launch: 1997.
On orbit: two.
Orbit altitude: 25,300 miles (apogee).

Milstar Satellite Communications System
Common Name: Milstar
In brief: joint communications satellite that provides secure, jam-resistant communications for essential wartime needs.

Major Military Satellite Systems, Continued

Function: EHF communications.
Operator: AFSPC.
First launch: Feb. 7, 1994.
On orbit: five.
Orbit altitude: 22,300 miles.

Mobile User Objective System
(also known as Advanced Narrowband System)
Common name: MUOS
In brief: next generation narrowband UHF tactical communications satellite to replace the UHF Follow-On Satellite (see below). Concept study contracts awarded in 1999; production award to Lockheed Martin in September 2004; initial launch in 2010.
Function: UHF tactical communications.
Operator: Navy.
First launch: 2010, planned.
On orbit: none.
Orbit altitude: 22,300 miles.

Space Based Infrared System High
Common name: SBIRS High
In brief: advanced surveillance system for missile warning, missile defense, battlespace characterization, and technical intelligence. System initially will complement, then replace, Defense Support Program spacecraft (see p. 63).
Function: infrared space surveillance.
Operator: AFSPC.
First launch: 2009, planned.
On orbit: none.
Orbit altitude: 22,300 miles.

Space Based Surveillance System
Common name: SBSS
In brief: Will replace the Midcourse Space Experiment/Space Based Visible (MSX/SBV) satellite that performs tracking and optical signature collection on Earth-orbiting objects.
Function: space surveillance.
Operator: AFSPC.
First launch: 2009, planned.
On orbit: one Pathfinder satellite to be launched in 2009 and four operational satellites are planned for the 2014 timeframe.
Orbit altitude: 528 miles.

Space Tracking and Surveillance System
(formerly SBIRS Low)
Common name: STSS
In brief: infrared surveillance and tracking satellites to detect and track ballistic missiles from launch to impact. System is sensor component of layered ballistic missile defense system and will work with SBIRS High (see above).
Function: infrared surveillance.
Operator: MDA (acquisition); AFSPC.
First launch: May 5, 2009
On orbit: one.

UHF Follow-On Satellite
Common name: UFO
In brief: new generation satellites providing secure, anti-jam communications; replaced FLTSATCOM satellites.
Function: UHF and EHF communications.
Operator: Navy.
First launch: March 25, 1993.
Constellation: four primary, four redundant.
On orbit: nine.
Orbit altitude: 22,300 miles.

Wideband Global SATCOM
Common name: WGS
In brief: multiservice program leveraging commercial methods to rapidly design, build, launch, and support a constellation that will augment X-band satellite communications (DSCS) and one-way Ka-band (Global Broadcast System) while providing a new two-way Ka-band service (see p. 63).
Function: wideband communications and point-to-point service (Ka-band and X-band frequencies).
Operator: AFSPC (bus); SMDC/ARSTRAT (payload).
First launch: Oct. 10, 2007.
On orbit: six, planned.
Orbit altitude: 22,000+ miles.

Dark and Spooky
A number of intelligence satellites are operated by US agencies in cooperation with the military. The missions and, especially, the capabilities are closely guarded secrets.
Most of the names of satellites, such as White Cloud (ocean reconnaissance), Aquacade (electronic ferret), and Trumpet (Sigint), are essentially open secrets but cannot be confirmed by the Intelligence Community.

Major Civilian Satellites in US Military Use

AMERICOM Government Services
Common name: AGS
In brief: Global commercial satellite communications solutions for the US government, including the military (hosted payloads, custom networks, bandwidth).
Function: communications.
Operator: SES.
First launch: December 1975.
Constellation: 40.
Orbit altitude: GEO (22,300 miles).

GeoEye-1
Common name: GeoEye-1
In brief: high-resolution imagery providing geospatial intelligence to National Geospatial-Intelligence Agency as part of NGA's Nextview program, in support of national security.
Function: Earth imagery.
Operator: Geo-Eye Inc.
First launch: Sept. 6, 2008.
Constellation: one.
Orbit altitude: 423 miles.

Geostationary Operational Environmental Satellite
Common name: GOES
In brief: in equatorial orbit to collect weather data for short-term forecasting.
Function: storm monitoring and tracking, meteorological research.
Operator: NOAA.
First launch: Oct. 16, 1975 (GOES-1).
Constellation: two, with on-orbit spare.
Orbit altitude: 22,300 miles.

Globalstar
Common name: Globalstar
In brief: mobile communications with provision for security controls.
Function: communications.
Operator: Globalstar L.P.
First launch: February 1998.
Constellation: 48.
Orbit altitude: 878 miles.

Ikonos
Common name: Ikonos
In brief: one-meter resolution Earth imaging.
Function: remote sensing.
Operator: GeoEye Inc.
First launch: Sept. 24, 1999.
Constellation: one.
Orbit altitude: 423 miles.

Inmarsat
Common name: Inmarsat
In brief: peacetime mobile communications services, primarily by US Navy.
Function: communications.
Operator: International Maritime Satellite Organization.
First launch: February 1982 (first lease), Oct. 30, 1990 (first launch).
Constellation: nine.
Orbit altitude: 22,300 miles.

Intelsat
Common name: Intelsat
In brief: routine communications and distribution of Armed Forces Radio and TV Services network.
Function: communications.
Operator: International Telecommunications Satellite Organization.
First launch: April 6, 1965 (Early Bird).
Constellation: 51.
Orbit altitude: 22,300 miles.

Iridium
Common name: Iridium
In brief: voice, fax, data transmission.
Function: handheld, mobile communications.
Operator: Iridium L.L.C.
First Launch: May 5, 1997.
Constellation: 66 (six on-orbit spares).
Orbit: 485 miles.

Landsat
Common name: Landsat
In brief: imagery use includes mapping and planning for tactical operations.
Function: remote sensing.
Operator: US Geological Survey.
First launch: July 23, 1972.
Constellation: one.
Orbit altitude: 438 miles (polar).

National Polar-orbiting Operational Environmental Satellite System
Common name: NPOESS
In brief: advanced joint civil-military polar environmental satellite that provides weather, atmosphere, ocean, land, and near-space data. Managed by tri-agency

(DOD, Department of Commerce, and NASA) integrated program office. Designed to replace USAF's DMSP and NOAA's Polar-orbiting Operational Environmental Satellite (POES) (see below).
Function: worldwide environmental forecasting.
Operator: IPO (AFSPC for acquisition and launch; NOAA for operations).
First launch: 2010, planned.
Constellation: three.
On orbit: none.
Orbit altitude: 550 (LEO) miles.

Orbcomm
Common name: Orbcomm
In brief: potential military use under study in Joint Interoperability Warfighter Program.
Function: mobile communications.
Operator: Orbcomm Global L.P.
First launch: April 1995.
Constellation: 30.
Orbit altitude: 500-1,200 miles.

Pan Am Sat
Common name: Pan Am Sat
In brief: routine communications providing telephone, TV, radio, and data.
Function: communications.
Operator: Pan Am Sat.*
First launch: 1983.
Constellation: 21.
Orbit altitude: 22,300 miles.
*Merged with Intelsat 2005-06

Polar-orbiting Operational Environmental Satellite
(also known as NOAA-K, L, and M before launch; NOAA-15, 16, and 17, respectively, once on orbit)
Common name: POES
In brief: two advanced third generation environmental satellites (one morning orbit and one afternoon orbit) provide longer-term weather updates for all areas of the world. Final two spacecraft in this series are NOAA-N (launched in 2005) and N Prime. To be replaced by NPOESS.
Function: extended weather forecasting.
Operator: NOAA (on-orbit); NASA (launch).
First launch: May 13, 1998 (NOAA-15).
Constellation: two.
Orbit altitude: 517 miles.

Quickbird 2
Common name: Quickbird 2
In brief: high-resolution imagery for mapping, military surveillance, weather research, and other uses.
Function: remote sensing.
Operator: DigitalGlobe.
First launch: Oct. 18, 2001.
Constellation: one.
Orbit altitude: 279 miles.

Satellite Pour l'Observation de la Terre
Common name: SPOT
In brief: terrain images used for mission-planning systems, terrain analysis, and mapping.
Function: remote sensing.
Operator: SPOT Image S.A. (France).
First launch: Feb. 22, 1986.
Constellation: three.
Orbit altitude: 509 miles.

Telstar
Common name: Telstar
In brief: commercial satellite-based, rooftop-to-rooftop communications for US Army and other DOD agencies.
Function: communications.
Operator: Loral Skynet.
First launch: November 1994.
Constellation: three.
Orbit altitude: 22,300 miles.

Tracking and Data Relay Satellite System
Common name: TDRSS
In brief: global network that allows other spacecraft in LEO to communicate with a control center without an elaborate network of ground stations.
Function: communications relay.
Operator: NASA.
First launch: April 1983.
Constellation: seven.
Orbit altitude: 22,300 miles.

WorldView-1
Common name: WorldView-1
In brief: high-resolution Earth imagery for mapping, military surveillance, and other uses.
Function: remote sensing.
Operator: DigitalGlobe.
First launch: Sept. 18, 2007
Constellation: one.
Orbit altitude: 308 miles.

Major US Military Ground-Based Space Surveillance Systems

Air Force Space Surveillance System
Common name: Air Force Fence
In brief: continuous wave radars located across the southern US to track man-made objects in Earth orbit.
Function: space surveillance.
Operator: AFSPC.
Operational: March 31, 1959 (US Navy).
Unit location: Dahlgren, Va. (command & control); receivers in Arkansas, California, Georgia, Mississippi, and New Mexico; transmitters in Alabama, Arizona, and Texas.
Components: One command & control center, six receiver sites, and three transmitter sites.

AN/FPS-85 Phased-Array Radar
Common name: Eglin radar
In brief: active phased-array radar used in all weather to track man-made objects in Earth orbit.
Function: space surveillance.
Operator: AFSPC.
Operational: Jan. 29, 1969.
Unit location: Eglin AFB, Fla.
Components: AN/FPS-85 solid-state phased-array radar.

Ballistic Missile Early Warning System
Common name: BMEWS
In brief: phased-array radar used for tactical warning and attack assessment and tracking Earth-orbiting satellites.
Function: ballistic missile attack and space surveillance.
Operator: AFSPC.
Operational: 1959 (Trinidad, British West Indies); July 1, 1961 (Clear AFS, Alaska).
Unit location: Clear AFS, Alaska; RAF Fylingdales, Britain; Thule AB, Greenland.
Components: (Clear AFS) AN/FPS-120 solid-state phased-array radar (SSPAR) with two faces; computers for radar control and data processing.

Ground-based Electro-optical Deep Space Surveillance
Common name: GEODSS
In brief: optical system that tracks objects such as Earth-orbiting satellites in deep space.
Function: space surveillance.
Operator: AFSPC.
Operational: June 30, 1982.
Unit location: Socorro, N.M.; Diego Garcia, Indian Ocean; Maui, Hawaii.
Components: three telescopes, low-light-level EO cameras, and high-speed computers.

Morón Optical Space Surveillance
Common name: MOSS
In brief: optical system that tracks objects such as Earth-orbiting satellites in deep space.
Function: space surveillance.
Operator: AFSPC.
Operational: June 1998.
Unit location: Morón, Spain.
Components: optical telescope and high-speed computers.

Pave Phased-Array Warning System
Common Name: Pave PAWS
In brief: Phased-array radar used to detect and track sea-launched and intercontinental ballistic missiles, as well as Earth-orbiting satellites.
Function: missile warning and space surveillance.
Operator: AFSPC.
Operational: August 1980.
Unit location: Beale AFB, Calif.; Cape Cod AFS, Mass.
Components: AN/FPS-115 phased-array radar; computers for radar control and data processing.

Perimeter Acquisition Radar Attack Characterization System
Common name: PARCS
In brief: ICBM and SLBM warning and space surveillance of Earth-orbiting satellites in deep space.
Function: ballistic missile warning and space surveillance.
Operator: AFSPC.
Operational: 1977.
Unit location: Cavalier AFS, N.D.
Components: One AN-FPQ-16 single-faced, phased-array radar. ■