
U.S. Defense Department Resources

THE U.S. DEPARTMENT OF DEFENSE (DOD) and individual U.S. armed services produce numerous resources on space warfare and defense. These materials can include reports of weapons systems' test results, congressionally mandated policy program updates, military doctrinal statements from individual armed services, scientific and technical reports, theoretical speculations on what warfare in space may look like, and other topics.

This chapter examines the multifaceted information resources on space warfare and defense produced by DOD and the individual armed services with particular emphasis on resources produced by the U.S. Air Force and its component entities. These resources reflect a wide range of viewpoints depending on the political, military, and budgetary priorities of the presidential administration or armed service branch they were written for.

U.S. Department of Defense

The current institutional incarnation of the DOD dates from 1949 National Security Act amendments establishing it as an executive department headed by the secretary of Defense. DOD's primary responsibility is providing the military forces necessary to defend the United States and its national interests.

A global access point to DOD and military resources is the Web site www.defense.gov. A useful overall resource for U.S. military policy and space warfare policy is the secretary of Defense's *Annual Report* to the president and Congress. Published by DOD's Office of the Executive Secretary, this publication is accessible from 1996–present at www.defenselink.mil/execsec/adr_intro.html and also features reports from the Secretaries of the Air Force, Army, and Navy, which may contain information about the space strategies and policies of those armed services.

Defense Advanced Research Projects Agency

The Defense Advanced Research Projects Agency (DARPA) was established in 1958. Its original mission was preventing the United States from being surprised by technological events such as the Soviet launch of Sputnik. This basic objective remains today,



The Pentagon in Arlington, Virginia houses the Department of Defense. It is the world's largest office building and approximately 25,000 people work there. (*Library of Congress*)

although DARPA also seeks to create technological surprise for U.S. enemies. DARPA engages in advanced and applied research and development programs for DOD and conducts prototype projects that may be included in future DOD or military projects. A key DARPA mission is placing particular emphasis on capabilities future military commanders might want and expediting those capabilities into existence through technology demonstrations.

The highly specialized nature of DARPA's work is executed by technical and support offices such as the Advanced Technology Office, Defense Sciences Office, Information Processing Technology Office, Information Exploitation Office, Microsystems Technology Office, Special Projects Office, and Tactical Technology Office. Programmatic work carried out by these offices occurs in space control applications, information assurance, biological warfare defense, advanced mathematics, national security warning and decision making, space systems development, next-generation computational and information systems, mobile distributed command and control, sensors and sensor exploitation, precision kill capabilities, defenses against low-technology air vehicles and missiles, and defenses against GPS jamming.

Further information about DARPA activities is available at www.darpa.mil/. These include news releases (1997–present), detailed descriptions on the activities of DARPA organizational components, agency budget information, and details on how to do busi-

ness with DARPA. Detailed descriptions are also provided for ongoing or historical DARPA programs with relevant space warfare and defense programs including Geospatial Representation and Analysis, Global Positioning Experiments, High Precision Laser Designator, Innovative Space-Based Radar Antenna Technology, Integrated Battle Command, Multi-function Electro-Optics for Defense of U.S. Aircraft, Novel Satellite Communication, Persistent Ocean Surveillance, Space Surveillance Telescope, and Synthetic Aperture Radar for Tactical Imaging. The video Web cast *DARPA's Space Legacy* (2002) provides additional institutional historical background.

Defense Information Systems Agency

The Defense Information Systems Agency (DISA) was established by the secretary of Defense as the Defense Communications Agency in 1960 and received its current name in 1991. DISA plays a crucial role in ensuring the security of U.S. military command, control, communications, and information systems and the communication needs of U.S. political and military leaders under peace and wartime conditions. It provides various kinds of technical support to the secretary of Defense and military agencies, ensures the interoperability of the Worldwide Military Command and Control System, the Defense Communications System, theater and tactical command and control systems, related NATO and allied communication systems, and national security emergency preparedness telecommunications functions of the National Communications System prescribed by Executive Order 12472.

DISA's Web site (www.disa.mil) provides additional information about the agency's functions and activities though it contains many resources restricted to users in the .gov or .mil Internet domains. Examples of publicly accessible resources include an organizational chart, press releases, business contracting information, and links to the Web sites of DISA military combatant command offices such as Strategic Command.

Defense Science Board

The Defense Science Board (DSB) is part of the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics. It was established in 1956, and its responsibilities include reporting to the Assistant Secretary of Defense for Research and Development on science and technology developments of interest to DOD.

Historical and contemporary information on DSB activities can be found on its Web site, www.acq.osd.mil/dsb/. These resources include historical information and the board's charter, links to other armed service science advisory organizations, descriptions of current task forces and their activities (covering topics such as improvised explosive devices and 21st century strategic technology vectors), and newsletter (June 1998–present).

A particularly important feature of this Web site is the text of DSB reports from 1993–present. Noteworthy examples of these reports covering aspects of space warfare and defense include *Report of the Defense Science Board Task Force on Simulation, Readiness,*

and Prototyping (1993), *Tactics and Technology for 21st Century Military Superiority* (1996), *Space and Missile Tracking System* (1996), *Theater Missile Defense* (1996), *Satellite Reconnaissance* (1998), *High Energy Laser Weapons Systems Applications* (2001), *Acquisition of National Security Space Programs* (2003), *Missile Defense Phase III Modeling and Simulation* (2004), *Contributions of Space-Based Radar to Missile Defense* (2004), *The Future of the Global Positioning System* (2005), and *US/UK Task Force Report-Defense Critical Technologies* (2006).

Defense Support Program Satellites

Defense Support Program (DSP) satellites are operated by the U.S. Air Force Space Command. The purpose of these satellites is protecting the United States and its allies by detecting missile launches, space launches, and nuclear detonations. DSP has existed since the early 1970s, and its satellites use an infrared sensor to detect heat from missile and booster plumes against the earth's background while being in geosynchronous orbit



The Air Force Space Command-operated Defense Support Program (DSP) satellites are a key part of North America's early warning systems. In their 22,300-mile geosynchronous orbits, DSP satellites help protect the United States and its allies by detecting missile launches, space launches, and nuclear detonations. (*Northrop Grumman*)

22,300 miles above the earth. Data from DSP satellites is relayed to various locations including the North American Aerospace and Defense Command and U.S. Space Command early warning centers in Cheyenne Mountain near Colorado Springs, Colorado.

Defense Technical Information Center and Scientific and Technical Information Network

The Defense Technical Information Center (DTIC) was started just after World War II to translate captured German and Japanese military scientific and technical information. Initially established as the Central Documents Office on October 13, 1948 by the secretaries of the Navy and Air Force, it became DTIC in October 1979. Overall information on DTIC is accessible at www.dtic.mil/, and its Scientific and Technical Information Network (STINET) provides access to a phenomenal number of full text reports on various defense subjects from defense contractors and military agencies.

Public access to DTIC-STINET resources is provided at <http://stinet.dtic.mil/>. Examples of these resources include a search thesaurus and descriptions of various component parts such as access to military journal articles and the space science collection. The highlight of this Web site, which makes it an essential resource for those studying space warfare and defense, is its repository of technical reports on assorted aspects of space warfare and defense. A representative sampling of these reports includes:

- *Reengineering the Doctrinal Latticework of Military Space* (1998) <http://handle.dtic.mil/100.2/ADA357705>
- *Determining if "Space Weather" Conditions Should Be Considered in the Intelligence Preparation of the Battlefield Process* (1998) <http://handle.dtic.mil/100.2/ADA350126>
- *Ballistic Missile Defense Technology Overview for the 7th Annual AIAA Technology Readiness Conference* (1998) <http://handle.dtic.mil/100.2/ADA355980>
- *Space as an Area of Responsibility (AOR), Is it the Right Solution?* (1998) <http://handle.dtic.mil/100.2/ADA363149>
- *Use of Commercial Space Assets by the Joint Force Commander* (1999) <http://handle.dtic.mil/100.2/ADA363150>
- *Component Based Simulation of the Space Operations Vehicle and the Common Aero Vehicle* (1999) <http://handle.dtic.mil/100.2/ADA363022>
- *Space Control for the Theater Commander: Naval Blockade as Precedent* (1999) <http://handle.dtic.mil/100.2/ADA370673>
- *Evaluation of the Space and Naval Warfare Systems Command (SPAWAR) Cost and Performance Measurement* (1999) <http://handle.dtic.mil/100.2/ADA373342>
- *Back to the Future: Space Power Theory and A.T. Mahan* (2000) <http://handle.dtic.mil/100.2/ADA432172>
- *The Viability of U.S. Anti-Satellite (ASAT) Policy: Moving Toward Space Control* (2000) <http://handle.dtic.mil/100.2/ADA435085>

- *Medium Brigade 2003: Can Space-Based Communications Ensure Information Dominance?* (2000) <http://handle.dtic.mil/100.2/ADA388156>;
- *Some Principles of Space Strategy (or "Corbett in Orbit")* (2000) <http://handle.dtic.mil/100.2/ADA430980>;
- *Navy Space Operations in the 21st Century: Sailing Among the Stars* (2000) <http://handle.dtic.mil/100.2/ADA378506>
- *Space Forces Support for the Joint Forces Commander: Who's In Charge?* (2000) <http://handle.dtic.mil/100.2/ADA378593>;
- *Space Weaponization* (2000) <http://handle.dtic.mil/100.2/ADA433750>
- *The "Space" of Aerospace Power: Why and How* (2000) <http://handle.dtic.mil/100.2/ADA394062>
- *Putting Space Control on the Front Burner in Operational Planning* (2000) <http://handle.dtic.mil/100.2/ADA381751>;
- *The Warfighters' Counterspace Threat Analysis (WCTA): A Framework for Evaluating Counterspace Threats* (2000) <http://handle.dtic.mil/100.2/ADA384609>
- *Improving Satellite Surveillance Through Optimal Assignment of Assets* (2003) <http://handle.dtic.mil/100.2/ADA419447>;
- *Redefining Military Activities in Space: A Viable Compromise Over the Military Uses of Space* (2004) <http://handle.dtic.mil/100.2/ADA426438>; and
- *United States National Security Policy and the Strategic Issues for DOD Space Control* (2005) <http://handle.dtic.mil/100.2/ADA431824>.

Defense Threat Reduction Agency

The Defense Threat Reduction Agency (DTRA) was created on October 1, 1998 from the preexisting Defense Special Weapons Agency. DTRA's institutional mandate involves protecting the United States and its allies by reducing the threat from weapons of mass destruction including chemical, biological, radiological, nuclear weapons, and high explosives. These defensive activities are carried out by DTRA personnel and resources emphasizing areas such as cooperative threat reduction, on-site inspection, technology security, combat security, and threat control and reduction on a global scale.

DTRA's Web site (www.dtra.mil) provides further information about agency activities and operations. Accessible materials include a Web cast video describing DTRA's work, resources on DTRA activities for enforcing various international arms control and security agreements such as the Nuclear Nonproliferation Treaty and the Strategic Arms Reduction Treaty with Russia, and links to various U.S. Government and international government organization reports on reducing the proliferation of weapons of mass destruction.

Numerous historical books describing DTRA activities are also accessible including *On-Site Inspections under the CFE Treaty: A History of the On-Site Inspections Agency and CFE Treaty Implementation, 1990–1996* (1996), *Treaty on Open Skies* (1999), and *Creating the Defense Threat Reduction Agency* (2002).

Department of Defense Directives

DOD issues numerous documents in its execution of U.S. national security policy. These publications include directives, issuances, instructions, administrative instructions, and other publications to carry out departmental activities and implement policies. DOD's Communications and Directives directorate is responsible for providing a single uniform system for executing departmental policies and procedures.

These directives and issuances are accessible at www.dtic.mil/whs/directives/. Understanding these documents requires presenting a more detailed description of their nature. DOD directives are broad policy documents containing what is required by the president, legislation, or the secretary of Defense to start, govern, or regulate actions conducted by DOD components. Directives also establish or describe programs or organizations, define missions, grant authority, and assign responsibilities.

Memorandums are issued by the secretary of Defense, deputy secretary of Defense, and their designated assistants. They are not published in the DOD directives system and implement policy documents such as DOD directives, federal laws, and executive orders. DOD instructions implement the policy and describe plans or actions for carrying out policies, operating programs and activities, and assigning responsibilities within these programs or activities. An Administrative Instruction is the medium implementing or supplementing DOD Directives or Instructions impacting the activities of the Office of the Secretary of Defense and DOD field agencies. There are several examples of DOD directives relating to space warfare and defense policy issues. Examples of these documents include *Directive 3200.11-D: Major Range and Test Facility Base Summary of Capabilities* (1983); *Directive 3230.3: DOD Support for Commercial Space Launch Activities* (1986); *Directive 3100.10: Department of Defense Space Policy* (1999); *Directive 3222.2: DOD Electromagnetic Environmental Effects (E3) Program* (2004); *Directive 4120.15: Designating and Naming Military Aerospace Vehicles* (2004); and *Directive 5134.9: Missile Defense Agency* (2004).

Joint Chiefs of Staff and the Joint Electronic Library

The Joint Electronic Library (JEL) is produced by the military's Joint Chiefs of Staff under DTIC auspices. JEL features information on the military doctrine of individual U.S. armed services along with theoretical and operational aspects involving the joint collaboration of all military forces. Information in JEL is intended to promote joint doctrine awareness and management among U.S. armed forces to enhance joint, inter-agency, and multinational interoperability along with enhancing military war-fighting capabilities. JEL is accessible at www.dtic.mil/doctrine/. These resources including the journal *Joint Force Quarterly* (Summer 1993–present) and a variety of doctrinal documents emphasizing how two or more armed services can work together to integrate missions and objectives in military operations. Examples of such publications include *Joint Pub 2–03 Joint Tactics, Techniques, and Procedures for Geospatial Information and Services Support to Joint Operations* (1999); *Joint Pub 3–01 Joint Doctrine for Countering Air and*

Missile Threats (1999); *Joint Pub 3–14 Joint Doctrine for Space Operations* (2002); and *Pamphlet for Future Joint Operations: Bridging the Gap Between Concepts and Doctrine* (2002).

Missile Defense Agency

The Missile Defense Agency (MDA) was established in January 2002 updating the Ballistic Missile Defense Organization created during the Clinton administration to replace the Strategic Defense Initiative Organization established during the Reagan administration.

MDA serves as the primary agency directing U.S. missile defense programs. In MDA's organic document, Secretary of Defense Donald Rumsfeld emphasized what he saw as DOD's primary missile defense priorities.

A. First, to defend the U.S., deployed forces, allies, and friends.

B. Second, to employ a Ballistic Missile Defense System (BMDS) that layers defense to intercept missiles in all phases of their flight (e.g., boost, midcourse, and terminal) against all ranges of threats.

C. Third, to enable the Services to field elements of the overall BMDS as soon as practicable. To that end, we have started to deploy the Patriot Advanced

A Standard Missile-3 (SM-3) is launched from the Aegis destroyer USS *Decatur* (DDG 73), during a Missile Defense Agency ballistic missile flight test on June 22, 2007. Two minutes later, the SM-3 intercepted a separating ballistic missile threat target, launched from the Pacific Missile Range Facility, Barking Sands, Kauai, Hawaii. The test was the ninth intercept, in eleven program flight tests, by the Aegis Ballistic Missile Defense, the maritime component of the "Hit-to-Kill" Ballistic Missile Defense System, being developed by the Missile Defense Agency. (*U.S. Navy*)



Capability-3 system [in 2002], after successful testing, as the first line of defense against short-range missiles.

D. Fourth, to develop and test new technologies, use prototype and test assets to provide early capability, if necessary, and improve the effectiveness of deployed capability by inserting new technologies as they become available or when the threat warrants an accelerated capability.

MDA's Web site (www.mda.mil) provides a profusion of information resources about agency activities and U.S. missile defense programs. Accessible resources include biographies of key agency officials, an organizational chart, ballistic missile frequently asked questions (FAQs) such as "How Fast is the Kill Vehicle Going When it Hits the Hostile Reentry Vehicle?," resources for prospective business contractors, news releases (1994–present), and Quicktime video webcasts of selected missile defense system tests.

Fact sheets are provided on various topics including *Aegis Ballistic Missile Defense* (2005); *Airborne Laser* (2005); *Command, Control, Battle Management, and Communications* (2005); *Ground-Based Midcourse Defense* (2005); *Sea-Based X-Band Radar* (2006); *Space Tracking and Surveillance System* (2005); *Targets and Countermeasures* (2005); and *Theater High Altitude Area Defense* (2005). A variety of reports are also provided on MDA's Web site including agency budget information from 1985–present; *MDA Glossary* (n.d.); *Report of the Panel on Reducing Risk in Ballistic Missile Defense Flight Test Programs* (1998); *Record of Decision to Establish a Ground-Based Midcourse Defense Extended Test Range* (2003); *Ballistic Missile Defense System Draft Programmatic Environmental Impact Statement* (2004); *A Day in the Life of the Ballistic Missile Defense System (BMDS)* (2005); *Ground-Based Midcourse Defense (GMD)*; *Sea-Based X-Band Radar (SBX) Placement and Operation*; and *Adak, Alaska Environmental Assessment and Draft Finding of No Significant Impact* (2005).

Joint National Integration Center

The Joint National Integration Center (JNIC) serves as MDA's research, testing, modeling, and simulation forum. Located near Colorado Springs, Colorado, JNIC's mission involves providing missile defense related analysis, system-level engineering, integration, and evaluation support for acquiring, developing, and deploying missile defense systems and architectures; supporting the development of joint and combined missile defense doctrine, research, and operational concepts; and supporting military combatant commands by integrating missile defense concepts, space exploitation, battle management command, control, communications, computers, and intelligence, and by conducting joint and combined simulations, war games, and participating in missile defense exercises as directed.

JNIC's Web site (www.mda.mil/jnic) provides additional information about center activities. These resources include descriptions of the activities of tenant organizations

such as the Center for Research Support, which is responsible for supplying satellite command and control support including satellite data processing, display, and distribution; the Cheyenne Mountain Training System whose activities include training operations crew members and some maintenance crew members assigned to Cheyenne Mountain Air Station along with replicating this base's training at the Missile Training Center and Space Training Center; and the Space Warfare Center whose institutional purpose is advancing U.S. space capabilities and employment concepts through tactics, developing, testing, analysis, and training programs.

Additional accessible resources provided through JNIC's Web site include employment opportunities, links to other MDA program components, and succinct descriptions of JNIC program areas such as interoperability testing, analysis, modeling and simulation, and war games and exercises.

National Geospatial Intelligence Agency

The National Geospatial Intelligence Agency (NGA) was created on November 24, 2003 when the 2004 Defense Authorization Act was signed into law. NGA replaced predecessor agencies such as the National Imagery and Mapping Agency (NIMA) established in 1996 and the Defense Mapping Agency established in 1972, which had additional predecessor agencies within the military. NGA's institutional mandate is providing timely imagery, imagery intelligence, and geospatial information supporting national security objectives to relevant policymakers.

NGA's Web site (www.nga.mil) provides information about agency activities, the text of a 2000 commission report on its NIMA predecessor agency, press releases (1996–present), information on careers and business opportunities within NGA, and assorted fact sheets and publications including *Terrain Visualization* (n.d.); *DOD Evasion Chart* (1996); *NGA's High-Resolution Terrain Information Test Range: Final Report* (2001); and *Geospatial Intelligence Basic Doctrine* (2004).

National Reconnaissance Office

The National Reconnaissance Office (NRO) is responsible for conducting satellite surveillance for U.S. intelligence agency and military operations, which it has done since 1961. Official acknowledgement of NRO's existence did not occur until it was declassified by the deputy secretary of Defense as recommended by the Director of Central Intelligence on September 18, 1992.

NRO's Web site (www.nro.gov) features assorted resources describing the office's activities. These include information on doing business with NRO; news releases (1995–present); selected speeches by NRO officials, such as the March 16, 2006 NRO budget request statement made by NRO director Dr. Donald M. Kerr before the House Armed Services Committee; imagery from the historic Corona intelligence reconnaissance satel-

lite program that NRO was involved with and Web casts describing Corona; biographical information about current and former NRO Directors; and an organizational chart featuring the names of NRO component entities, such as the Signals Intelligence Systems Acquisitions and Operations Directorate and Office of Space Launch.

National Security Space Office

The National Security Space Office (NSSO) is part of the Office of the Undersecretary of Defense for Acquisition, Technology, and Logistics. NSSO was established in May 2004 by merging the National Security Space Architect and National Security Space Integration offices. NSSO's purpose is integrating and coordinating defense and intelligence space activities to achieve unified effort. Its Web site is www.acq.osd.mil/nssso/.

Strategic Command

Strategic Command, also called United States Strategic Command (STRATCOM) is located at Offut AFB, Nebraska. STRATCOM is one of the military's nine unified combatant commands, and it is charged with providing the U.S. global deterrence capabilities and synchronizing DOD efforts to combat adversary weapons of mass destruction on a global scale. STRATCOM seeks to achieve such capabilities through advocating and applying integrated intelligence, surveillance, and reconnaissance (ISR); space and global strike operations; information operations; integrated missile defense; and assertive command and control.

Command origins date back to the March 1946 creation of the U.S. Air Force's Strategic Air Command (SAC) at Offut where SAC bombers served as the genesis of the U.S. emerging nuclear deterrent against the Soviet Union's nuclear arsenal. STRATCOM replaced SAC on June 1, 1992 following the Soviet Union's collapse. This new organization brought the planning, targeting, and wartime employment of U.S. strategic forces under a single commander while daily force training, maintenance, and equipment responsibilities stayed with the Air Force and Navy. A separate Space Command force existing at this time was merged into STRATCOM on October 1, 2002.

STRATCOM's Web site (www.stratcom.mil) features information about organizational entities including Joint Functional Component Commands (JFCC) for Integrated Missile Defense, Intelligence, Surveillance, and Reconnaissance, Network Warfare, Space and Global Strike, and the Joint Information Operations Center. Additional resources include biographies of key STRATCOM personnel, a succinct command history, recent news releases, and speeches and congressional testimony from STRATCOM leaders.

Fact sheets on organizational activities are also provided with representative samples including *Manned Space Flight Support* (2004); *Military Space Forces* (2004); *Space Control* (2004); *Joint Functional Component Command for Integrated Missile Defense* (2005); *Theater Ballistic Missile Warning* (2005); and *Global Operations Center* (2006).

Joint Functional Component for Space and Global Strike

The Joint Functional Component for Space and Global Strike (JFCCSGS) is part of Strategic Command and was established in January 2005. It is responsible for optimizing operational planning, execution, and force management for STRATCOM's mission of deterring attacks against the United States. JFCCSGS collaborates with other government and military agencies to support or execute global space or strike operations. This can involve providing integrated analysis of STRATCOM's global mission capabilities, developing and providing space and global strike execution recommendations, providing continual space situational awareness of assigned space forces, and coordinating and maintaining tactical level intelligence supporting operational needs for space and global strike component commands. The JFCCSGS Web site (www.stratcom.mil/SGS) provides information such as biographies of leaders, how JFCCSGS relates to other STRATCOM entities, and access to the Offut AFB newsletter *Air Pulse*. The major source of information on this Web site is detailed descriptions of JFCCSGS organizational entities and their responsibilities. These component parts include J0 (Office of the Commander and the Staff Support Agencies), which is responsible for the command's goals, mission, vision, and leadership; J1 (Manpower and Personnel) whose responsibilities include administrative and personnel support to those assigned to JFCCSGS staff; J2 (Intelligence), which is responsible for presenting clear, accurate, predictive, and timely analysis of military situations to assist commanders and staff in their planning and decision making; J3 (Operations), which manages the Global Operations Center by providing global mission area situational awareness to STRATCOM senior leadership while also conducting mission analysis, leading course of action development, and performing contingency and crisis action planning; and J4 (Logistics), which monitors daily logistics capability to support forces and provides expertise as required.

Additional JFCCSGS organizations and their responsibilities include J5 (Plans and Policy), which is responsible for providing planning products and planning support to STRATCOM deliberative/adaptive planning efforts and other military planning efforts for national and theater level objectives; J6 (C4 Systems), which provides functional, maintenance, and sustainment support for operational command and control systems to ensure their reliability across the combat spectrum; J7 (Exercises), which serves as the primary integrating organization supporting JFCCSGS exercises, war gaming, readiness, and training requirements in support of command space, global strike, and information operations objectives; and J8 (Capability and Resource Integration), which is responsible for planning, programming, and executing the command's annual budget.

Joint and Individual U.S. Armed Service Resources

Various resources on space warfare and defense are produced by joint military entities (supporting the operations of two or more armed services) and individual branches of

the U.S. armed forces. These consist of professional military education institutions such as National Defense University and Air University and units and facilities of individual armed services such as the Air and Space Expeditionary Force Center and Army Space and Missile Defense Command. These organizations and their information resources are profiled below.

National Defense University

National Defense University (NDU) and its component organizations train military and civilian leaders from the United States and other countries for national security policy-making positions. NDU also seeks to provide augmented understanding of U.S. and international security issues as part of its research mission.

Further information about NDU and its multifaceted component parts is accessible at www.ndu.edu/. Examples of NDU entities with numerous freely accessible Web-based resources dealing with space warfare and defense include the NDU Library, Institute for National Strategic Studies, Center for Technology and National Security Policy, and Center for the Study of Chinese Military Affairs.

NDU educational institutions such as the Industrial College of the Armed Forces and National War College also produce pertinent information resources that are profiled below.

Industrial College of the Armed Forces

The Industrial College of the Armed Forces (ICAF) was established in 1924 as the Army Industrial College. It acquired its current name in 1946 and became part of NDU in 1976. ICAF's institutional mandate is to prepare selected military officers and civilians for senior leadership and staff positions by engaging in postgraduate and affiliated research on national security strategy and industrial resources, placing particular emphasis on how acquisition and joint logistics are integrated into national security strategy. The ICAF Web site (www.ndu.edu/icaf) provides additional information about college curricular and research missions. A particularly noteworthy resource is the detailed studies and analyses of individual defense and related industries prepared by ICAF students, which are accessible from 2000–present. Examples of relevant industry analyses prepared for 2004 include Aircraft, Electronics, Information Technology, Manufacturing, Space, and Weapons.

National War College

The National War College (NWC) was established in 1946 as an upgraded replacement for the combined Army–Navy staff college, which existed from 1943–1946. NWC has produced more than 8,000 graduates who have assumed positions in the U.S. military or government and foreign militaries and governments. The college's mission is to prepare



Eagle adorns loggia of the National War College at Fort Lesley J. McNair in Washington, D.C. The National War College is one of the U.S. major professional military educational institutions. (*Library of Congress*)

future armed forces leaders, State Department officials, and leaders for other civilian governmental agencies for high-level policy, command, and staff responsibilities through senior-level curriculum and research in national security policy and strategy.

Information about NWC and its curricular and research activities is accessible at www.ndu.edu/nwc/. These resources include clip art of foreign weapons systems, the current *Student Handbook*, faculty biographical information and descriptions of their areas of expertise, and descriptions of the college's writing programs.

A National War College highlight is the presence of student research papers on various national security policy topics. Representative samples of these works include "The Evolution of the National Reconnaissance Office: Out From Deep Black Space and into the Defense Bureaucracy" (1995); "The 1972 Anti-Ballistic Missile Treaty: A Need for Change" (1996); "Deploying an Operational Anti-Satellite Capability: A Need for Change" (1996); "National Missile Defense: High Technology in a Strategic Vacuum" (2000); "Back to the Future: Space Power Theory and A.T. Mahan" (2000); "The Rise and Fall of the 1972 Anti-Ballistic Missile Treaty: A Study of U.S. Decisionmaking" (2003); and "The High Ground" (2004).

U.S. Air Force

The United States Air Force (USAF) was established by the 1947 National Security Act and is a military department within DOD. USAF is headed by the secretary of the Air Force and operates under the secretary of Defense's authority, direction, and control. The secretary of the Air Force is concerned with the organization, training, logistical assistance, administration, research and development, and other USAF activities as directed by the president and secretary of Defense. USAF's overall mission is defending the United States by controlling and exploiting air and space. Although USAF is considered the preeminent U.S. armed service dealing with military space policy its activities in this area are also partially duplicated by the Army and Navy.

General information about USAF activities, operations, and policies is accessible at www.af.mil/. The next group of entries examines the multifaceted resources on space warfare and defense produced by USAF component organizations.

Air Force Doctrine Center

The Air Force Doctrine Center (AFDC) is located at Maxwell AFB, Alabama and is responsible for researching, developing, producing, and storing USAF statements on various military operations covering strategic and tactical aspects of service missions (U.S. Air Force 2005, 1). AFDC is accessible at www.e-publishing.af.mil/. Representative samples of AFDC publications covering space warfare include *Spacelift Operations* (1998); *Space Warning Operations* (1998); *Satellite Command and Control Operations* (1999); *Operational Test and Evaluation for Space and Intercontinental Ballistic Missile (ICBM) Systems* (2001); *Air Force Space Command Unit Intelligence Support* (2003); *Space Control/Surveillance Operations* (2004); and *Launch and Range Roles and Responsibilities* (2005).

Air Force Office of Scientific Research

The Air Force Office of Scientific Research (AFOSR) is located in Washington, D.C. and has various domestic and international locations. AFOSR was established in 1951 in the headquarters of the Air Force Research and Development Command. Its creation derives from the realization that there is an intimate relationship between science, technology, and air force operations. Consequently, AFOSR has been responsible for sponsoring cutting-edge scientific research to assist the Air Force in its operational planning. AFOSR's Web site (www.afosr.af.mil) describes and details the activities of research program areas such as Aerospace and Materials Sciences and Physics and Electronics, along with descriptions of programs within these areas such as space power and propulsion, unsteady aerodynamics and hypersonics, remote sensing and imaging, sensors in the space environment, space electronics/university nanosatellites, and space sciences. The Web site

also includes the newsletter *Research Highlights* (1995–present) and technical articles on space operations and satellites from the magazine *Technology Horizons*.

The Scientific Advisory Board (SAB) is affiliated with AFOSR and promotes the exchange of scientific and technical information between USAF and the scientific community that can strengthen Air Force service missions (U.S. Air Force Scientific Advisory Board n.d., 1). SAB's Web site (<https://www.sab.hq.af.mil>) provides information about board activities including listings and biographies of board members and descriptions of reports, which are accessible through the DTIC STINET Web site (<http://stinet.dtic.mil>). Examples of SAB reports accessible through this site include *New World Vistas: Air and Space Power for the 21st Century* (multiple volumes) (1996) and *Space Surveillance, Asteroids, Comets, and Space Debris: Volume 1 Space Surveillance* (1997). SAB's Web site also provides summaries of recent and ongoing research projects such as *Operationalizing Space Launch* (2004), *Persistence at Near Space Altitudes* (2005), and *Space Survivability* (2006).

Air University

Air University (AU) is located at Maxwell AFB, Alabama. Since its 1946 establishment, AU's mission has been to conduct professional military, graduate, and continuing education for officers, enlisted personnel, and civilians to prepare them for leadership, command, staff, and management responsibilities. These leadership missions are augmented by research in aerospace education, leadership, and management while also playing an integral role in developing and testing air force doctrine, concepts, and strategy. These instructional and research missions are carried out by AU component organizations such as Air War College; Air Command and Staff College; College of Aerospace, Doctrine, Research, and Education; School of Advanced Air and Space Studies; and Air University Press.

General information about AU operations and entities can be found at www.au.af.mil. The crucial importance of AU information resources in conducting space warfare and defense research, and the depth and extent of these resources, are demonstrated in the next several entries of this chapter.

Air University Center for Strategy and Technology

The Air University Center for Strategy and Technology (CSAT) was established at AU's Air War College in 1996. CSAT's mission is engaging in long-term strategic thinking about technological implications of U.S. national security. The Center emphasizes education, research, and publishing supporting the integration of technology into national strategy and policy. CSAT is supported by strategic, scientific, and technological institutions, and it seeks to engage with Air Force and other DOD organizations to identify potential research project topics with the results of these findings being disseminated to senior military and political leaders, think tanks, educational institutions, and other interested parties (Air University, Center for Strategy and Technology 2005, 1).

Further information about CSAT is available at <http://csat.au.af.mil/>. Resources provided here include links to the Web sites of military and civilian government research laboratories, links to selected think tank Web sites, and various scientific and technology publications. Accessible CSAT publications include the following examples from CSAT's Occasional Paper series *Lasers in Space: Technological Options for Enhancing U.S. Military Capabilities* (1997); *Lasers and Missile Defense: New Concepts for Space-Based and Ground-Based Laser Weapons* (1998); *Weaponization of Space: Understanding Strategic and Technological Inevitabilities* (1999); *Airborne and Space-Based Lasers: An Analysis of Technological and Operational Compatibility* (1999); *Reusable Launch Vehicles: Rethinking Access to Space* (2000); *Using Lasers in Space: Laser Orbital Debris Removal and Asteroid Deflection* (2000); *Space-Based Global Strike: Understanding Strategic and Military Implications* (2001); *Sustained Space Superiority: A National Strategy for United States* (2002); and *The Decision Maker's Guide to Robust, Reliable, and Inexpensive Access to Space* (2004).

CSAT's Web site also provides links to recent historical Air Force studies speculating on the roles space will play in future military operations with these studies including *Spacecast 2020* (1993–1994), *Air Force 2025* (1996), and the multivolume *New World Vistas: Air and Space Power in the 21st Century* (1996).

Air University Library

The Air University Library (AUL) provides a variety of information resources for Air University faculty and students and some resources for users not affiliated with the university. General access to AUL is provided at <http://aulibrary.maxwell.af.mil/>. From here it is possible to search the library's Online Public Access Catalog (OPAC), which may include links to full text reports, the Air University Library Index to Military Periodicals (AULIMP) <http://purl.access.gpo.gov/GPO/LPS3260>, which provides bibliographic citations to articles from military science journals from 1988–present, links to other AU research center Web sites and publications, and Web-based bibliographies on various military and international political topics with representative samples including *Asymmetric Warfare* (2005); *Ballistic Missile Defense* (2005); *Counterspace* (2003); *Intelligence, Surveillance, and Reconnaissance (ISR) Programs* (2005); *Precision Guided Munitions* (2005); *Separate Space Force* (2005); and *Space: Military Aspects* (2005).

Air University Press

Air University Press (AUP) was established September 28, 1953 by General Order No. 54 from AU's Deputy Commander General John DeForrest Baker. This document stressed that AUP was to publish significant research and scholarly contributions consistent with the university's mission, which will enhance institutional recognition and scholarly cachet in the academic community.



Fairchild Library located at the Air University at Maxwell Air Force Base in Alabama. (U.S. Department of Defense)

General information about AUP is accessible at www.au.af.mil/au/aul/aupress/. Accessible resources include information about press operations, how prospective authors can submit manuscripts, how to order books, and the full text of many press publications on various military topics including space warfare and defense. Examples of accessible books include *Battlefield of the Future: 21st Century Warfare Issues* (1998); *The Air Force Role in Developing International Outer Space Law* (1999); *Beyond the Paths of Heaven: The Emergence of Space Power Thought* (1999); *Into the Unknown Together: The DOD, NASA, and Early Spaceflight* (2005); and *Space Power Integration: Perspectives from Space Weapons Officers* (2006).

AUP also published distinct series of reports on various aspects of aerospace power doctrine, which are profiled below.

CADRE Papers

CADRE Papers are reports produced under the auspices of AU's College of Aerospace, Doctrine, Research, and Education (CADRE), which seeks to deliver a multidimensional education, research, and war-gaming pedagogical experience to develop leaders capable of applying air, space, and cyberspace power into military operations.

CADRE is responsible for producing *Air and Space Power Journal*, available at <http://purl.access.gpo.gov/GPO/LPS951> (1967–present), which is USAF's professional military

journal. CADRE Papers are accessible at www.au.af.mil/au/aul/aupress/Indexes/title_ndx_cadre.htm. Examples of space warfare and defense titles in this series include *Does the United States Need Space-Based Weapons?* (1999) and *Flying Reactors: The Political Feasibility of Nuclear Power in Space* (2005).

Fairchild Papers

Fairchild Papers are another AU Press monographic series accessible at www.au.af.mil/au/aul/aupress/Indexes/fairchild_papers_titles.htm. Pertinent space warfare and defense titles in this series include *Ten Propositions Regarding Space Power* (2002) and *Whither Space Power: Forging a Strategy for a New Century* (2002).

Maxwell Papers

The Maxwell Papers is another AU Press monographic series whose emphasis covers current and future issues of interest to the Air Force and DOD. Access to these analyses is available at www.au.af.mil/au/aul/aupress/Indexes/maxwell_papers_online.htm. Pertinent space war and defense titles in this series include *China as a Peer Competitor?: Trends in Nuclear Weapons, Space, and Information Warfare* (1999); *Growing the Space Industrial Base: Policy Pitfalls and Prospects* (2000); *U.S.-Led Cooperative Theater Missile Defense in North-east Asia: Challenges and Issues* (2000); *A Separate Space Force: An 80-Year Old Argument* (2000); *China in Space: Civilian and Military Developments* (2001); and *Enabling Intelligence, Surveillance, and Reconnaissance Effects for Effects-Based Operations Conditions* (2005).

Wright Flyers

Wright Flyers is a series of occasional papers sponsored by AU's Air Command and Staff College. These papers are accessible at www.au.af.mil/au/aul/aupress/Indexes/wright_flyers_online.htm with *Rapid Dominance: Integrating Space into Today's Air Operations Center* (2000) and *Microsoft, Al-Jazeera, and the Predator: The Challenge of Effects-Based Operations in the Global War on Terrorism* (2005) serving as representative samples of pertinent analysis from this series.

Air University Student Research Studies

As a graduate educational institution, AU faculty and students produce a variety of information resources. Some of those produced by AU faculty and affiliated scholars have already been profiled; here the focus is on student research papers dealing with space warfare and defense that are produced by students at AU's five major educational institutional programs: Air Command and Staff College, Air Force Fellows, Air Force Institute of Technology, Air War College, and School of Advanced Air and Space Studies. These

research papers and theses are all accessible at <https://research.au.af.mil/showstudent.aspx?type=student>, and chronological access to these resources dates back to 1992.

Air Command and Staff College

The Air Command and Staff College (ACSC) serves as the Air Force's professional military education school. ACSC responsibilities include preparing field grade officers, international military officers, and U.S. citizens to assume positions of increasing responsibility in military and other governmental areas. It emphasizes teaching the skills required for aerospace operations supporting joint commands as well as leadership and command. Examples of ACSC student papers on space warfare and defense include *Planetary Asteroid Defense Study: Assessing and Responding to the Natural Space Debris Threat* (1995); *The Military Utility of German Rocketry During World War II* (1997); *The Airborne Laser—A Revolution in Military Affairs* (1997); *Space Applications in the Logistics Arena: An Analysis of Project Combat Track* (1997); *Achieving Affordable Operational Requirements on the Space Based Infrared System (SBIRS): A Model for Warfighter and Acquisition Success* (1997); *Future Roles of Air and Space Power in Combatting Terrorism* (1997); *Distinguishing Space Power from Air Power: Implications for the Space Force Debate* (1998); *Space Power Theory: A Rising Star* (1998); *Clausewitz on Space: Developing Military Space Theory Through a Comparative Analysis* (1999); *How is U.S. Space Power Jeopardized by an Adversary's Exploitation, Technological Developments, Employment and Engagement of Laser Antisatellite Weapons* (2000); *Defending the Final Frontier: Commercial Space System Vulnerabilities to Directed Energy Weapon Threats* (2000); *Solar Power Constellations: Implications for the United States Air Force* (2000); *DOD Use of Commercial Wideband Satellite Communication Systems: How Much is Needed and How Do We Get It?* (2001); *The National Missile Defense Debate in the Post 9–11 Context* (2002); *Building a Cadre of Space Professionals With Responsible Lift* (2003); and *Spacepower Theory: Lessons from the Masters* (2005).

Air Force Fellows

The Air Force Fellows (AFF) program allows a small number of carefully chosen and experienced officers to serve one-year tours studying national security policy and strategy at civilian universities or think tanks. These AFF fellows provide advice on national security policy and explain USAF and DOD programs and policies to nationally recognized scholars, foreign dignitaries, and prominent policy analysts while gaining enhanced insights and understanding through their interactions with civilian leaders.

Samples of AFF space warfare and defense research analyses include *Making the Expeditionary Aerospace Force Work—Now!* (2000); *National Missile Defense: Laying the Groundwork for Future U.S. Security Policy* (2001); *Through a Glass, Darkly: Innovation and Transformation in the Twenty-First Century Air Force* (2001); *The International Development of*

Space and Its Impact on U.S. National Space Policy (2003); *Air and Space Expeditionary Force Crisis Action Leadership for Commanders* (2004); and *Flying Reactors: The Political Feasibility of Nuclear Power in Space* (2004).

Air Force Institute of Technology

The Air Force Institute of Technology (AFIT) is part of AU although it is located at Wright-Patterson AFB in Dayton, Ohio. AFIT serves as USAF's graduate engineering and management school and its technical professional continuing education institution.

General information about AFIT is accessible through its Web site, www.afit.edu/. Examples of AFIT student papers emphasizing scientific and technological aspects of space warfare and defense include *Whole Spacecraft Vibration Isolation* (1999); *Space Launch Operations and the Lean Aerospace Initiative* (1999); *Space Range Scheduling and the Lean Aerospace Initiative* (2000); *Navigation of Satellite Cluster* (2000); *Using GPS as a Reference System to Hit a Moving Target* (2001); *Parameter Study for Optimizing the Mass of a Space Nuclear Power System Radiation Shield* (2002); *Issues in Modeling Military Space* (2002); *Modeling Aerospace Ground Equipment Usage in Military Environments* (2002); *Space Time Adaptive Processing and Clutter Classification Integration and Evaluation* (2002); *The Air Warrior's Value of National Security Space* (2003); *Development, Fabrication, and Ground Test of an Inflatable Structure Space-Flight Experiment* (2003); *Characterization and Ground Test of an Inflatable Rigidizable Space Experiment* (2004); *Reusable Space Vehicle Ground Operations Baseline Conceptual Model* (2004); and *Design of a Space-Borne Autonomous Infrared Tracking System* (2004).

Air War College

Air War College (AWC) is the Air Force's senior professional school. AWC instruction and research emphasizes joint operations and using aerospace power to support national security while serving as a resource promoting education and dialogue on national and international aerospace issues.

Representative AWC student papers include *China's Space Program and Its Implications for the United States* (1995); *The New DOD Space Management Process: A Critical Analysis* (1996); *What the Warfighter Should Know About Space: A Report on U.S. Space Command Joint Space Support Teams* (1997); *Command and Employment of Space Power: Doctrine for the Asymmetric Technology of the 21st Century* (1997); *Increasing the Weaponization of Space: A Prescription for Further Progress* (1998); *Who Will Command the High Ground?: The Case for a Separate Area of Responsibility for Space* (1998); *Can the U.S. Air Force Weaponize Space?* (1998); *Planetary Defense: Legacy for a Certain Future* (1998); *Increased Military Reliance on Commercial Communications Satellites: Implications for the War Planner* (1998); *Military Dependence on Commercial Satellite Communication Systems—Strength or Vulnerability?* (1999); *Prompt Global Strikes Through Space: What*

Military Value? (2000); *The Command of Space: A National Vision for American Prosperity and Security* (2001); *How to Institutionalize Space Superiority in the United States Air Force* (2002); and *Spacepower as a Coercive Force* (2003).

School of Advanced Air & Space Studies

The School of Advanced Air and Space Studies (SAASS) seeks to educate strategists in the art and science of aerospace warfare. SAASS's faculty teach a graduate-level curriculum emphasizing the theories, history, applications, design, and effective expression of aerospace strategies, operational concepts, and related policies in the context of conflict, deterrence, and war. Students participating in this program have an average weekly reading demand of 1,200–1,500 pages, and they are required to prepare a thesis based on original source documents.

Pertinent SAASS student theses include *Concepts of Operations for a Renewable Space Launch Vehicle* (1996); *Safe Heavens: Military Strategy and Space Sanctuary Thought* (1997); *Does the United States Need Space-Based Weapons?* (1998); *Do We Need Separate Space Theory: The Lessons of History* (2001); *Defense or Deterrence?: The Future of Missile Defense* (2002); *Space Weapons and Space Power* (2003); *Globalness: Toward a Space Power Theory* (2003); *The Best Defense: Charting the Future of US Space Strategy and Policy* (2005); and *Theater Space Warfare: Rewriting the Joint Playbook* (2005).

National Space Studies Center

AU's National Space Studies Center (NSSC) is responsible for promoting and sponsoring research and education on employing space power by creating and maintaining a depository and clearinghouse for space information and expertise.

The NSSC Web site (<http://space.au.af.mil>) provides access to a variety of materials describing center activities. These include links to instructional materials such as AU course syllabi, space-related course material from NASA and civilian universities, links to DOD and military services space policy doctrinal documents, news about various civilian and military space developments, and links to space fact sheets from other Air Force organizations.

Accessible publications include the *Air University Space Primer* (2003) and links to other publications on military space produced by civilian, military, and governmental organizations.

U.S. Air Force Academy

The United States Air Force Academy (USAFA) is located in Colorado Springs, Colorado and is responsible for providing undergraduate education to facilitate the development of aerospace officers with the knowledge, discipline, and motivation to lead the USAF. The academy was established in 1954 and has an enrollment of approximately 4,000 cadets.



Cadets of the Air Force Academy Class of 2003 celebrate at graduation ceremonies as the Air Force Thunderbirds fly overhead. (U.S. Air Force)

General information about USAFA curriculum, programs, and research is accessible at the academy Web site, www.usafa.af.mil/.

Air Force Academy Institute for National Security Studies

The Air Force Academy's Institute for National Security Studies (INSS) was created in 1992 as a collaborative effort between the USAFA dean of faculty and the Policy Division of the Division of the Nuclear and Counterproliferation Directorate of USAF headquarters and became an independent research center in 2004. INSS's mission is promoting national security research for DOD within the military academic community while supporting the Air Force national security education program. During its first 12 years of existence, INSS has sponsored over \$2.5 million in research at military and civilian universities (U.S. Air Force Academy Institute for National Security Studies n.d., 1–2).

The INSS Web site (www.usafa.af.mil/df/inss) provides information about institute activities and reports produced under institute sponsorship as well as information on how to submit report proposals for possible INSS sponsorship. Access is provided to various publications including the institute's Occasional Papers series with relevant examples including *The Viability of U.S. Anti-Satellite Policy: Moving Toward Space Control* (2000); *United States Military Space: Into the 21st Century* (2002); *"All Our Tomorrows": A Long-*

Range Forecast of Global Trends Affecting Arms Control Technology (2002); *India's Emerging Security Strategy, Missile Defense, and Arms Control* (2004); and *The Art of Peace: Dissuading China From Developing Counter-Space Weapons* (2005).

Air Force Research Laboratory Directed Energy Directorate

The Air Force Research Laboratory Directed Energy Directorate (AFRLDED) is located at Kirtland AFB near Albuquerque, New Mexico. AFRLDED serves as DOD's leading center for lasers, high-power microwaves, and other directed energy technologies. Its multiple missions include supporting user needs for directed energy weapons applications and addressing mission area deficiencies; exploiting directed energy technology for USAF and DOD applications; enabling the Air Force to avoid technological surprise; fostering awareness of directed energy's potential for Air Force and DOD applications; and exploring directed energy technology offering high payoff for directed energy capabilities and applications.

AFRLDED's Web site (www.de.afrl.af.mil) contains additional information describing laboratory missions and activities. These resources include descriptions of AFRLDED program areas such as counter electronics, force protection, long-range strike, precision engagement, and space control, news releases (2004–present), descriptions of awards received by directorate personnel, and an image gallery describing specific directorate programs. A particularly useful feature of the AFRLDED Web site is the presence of numerous program fact sheets with examples including *YAL-1A Attack Laser: The World's First Laser-Armed Combat Aircraft* (2002); *High-Power Microwaves* (2002); *Airborne Laser* (2003); *Airborne Laser: A Brief History* (2003); *Testing: Paving the Way to Missile Shootdown* (2003); *Directed Energy Directorate: Developing Speed-of-Light Weaponry* (2004); and *Relay Mirror Technology* (2006).

Air Force Research Laboratory Sensors Directorate

The Air Force Research Laboratory Sensors Directorate (AFRLSD) is located at Wright-Patterson AFB in Dayton, Ohio. AFRLSD's mission is leading the discovery, development, and integration of affordable sensor and countermeasure technologies for U.S. war fighters, which enables complete air and space freedom for U.S. forces while denying sanctuary to hostile forces.

The AFRLSD Web site (www.afrl.af.mil/sn) features descriptive information about directorate programs in automatic target recognition and sensor fusion, electro-optical sensors and countermeasures technology, radio-frequency sensors and countermeasures technology, and descriptions about directorate research accomplishments in areas such as the new phase shifter electronically scanned antenna for space-based and unmanned combat air vehicle sensors, evaluating the joint air-to-surface stand-off missile's antijam

global positioning satellite system technology, software accelerating automated target recognition development, and other research and technological advances.

Air Force Research Laboratory Space Vehicles Directorate

The Air Force Research Laboratory Space Vehicles Directorate (AFRLSVD) is also located at Kirtland AFB with an adjunct branch at Hansom AFB, Massachusetts. AFRLSVD is responsible for developing and transitioning high-payoff space technologies supporting U.S. war fighters while also utilizing commercial, civil, and other governmental capabilities for national advantage.

The AFRLSVD Web site (www.vs.afrl.af.mil/Directorate) provides additional descriptions of directorate activities. These include information about directorate product lines involving battle-space environment, spacecraft technology, and integrated experiments and evaluation. These product lines conduct research and development in areas such as the solar mass ejection imager all-sky camera, detecting ionospheric atmospheric impacts on radio-frequency war-fighting systems, active sensors such as those used by space-based radars, and spacecraft instrumentation.

Additional information resources include news releases (2004–present), information on directorate interactions with the broader scientific community such as the Space Scholars Program, an image gallery of research areas, and fact sheets on various programs. Examples of these fact sheets include *XSS-11 Microsatellite* (2005); *Space Countermeasures Hands On Program* (2006); *Cryocoolers Infrared Sensors to Enable Space Intelligence, Surveillance, Reconnaissance, and Situational Awareness* (2006); and *The Communication/Navigation Outage Forecasting System* (2006).

U.S. Air Force Space Command

U.S. Air Force Space Command (AFSPACOM) is located at Peterson AFB in Colorado Springs, Colorado. AFSPACOM was activated on October 1, 1982 from several preexisting Air Force space operational entities. The command was initially organized to manage missile warning and space-tracking systems, and it would expand its sphere of influence by acquiring the Air Force's space launch mission and gaining control of the United States' intercontinental ballistic missile force in 1993. An important recent development in AFSPACOM's institutional evolution was DOD merging U.S. Space Command with STRATCOM in an effort to improve combat effectiveness and expedite information collection and assessment.

AFSPACOM's mission is defending the United States by controlling and exploiting space. It does this by providing routine and reliable space-based support for war fighters and continuously improving command abilities to support combat forces. AFSPACOM uses four mission areas to implement its operations: counterspace, space force enhancement,

space force application, and mission support. Counterspace refers to operations intended to attain and maintain a desired degree of space superiority by allowing friendly forces to maximize space capabilities while preventing adversaries from using these capabilities. Space force enhancement emphasizes providing capabilities to facilitate or support air, land, sea, and space military operations. Space force application consists of conducting global operations by directly and promptly applying force from and through space against terrestrial targets. Space support is responsible for managing launch and satellite operations; operating, servicing, recovery, and repositioning satellites once they are in orbit, and commanding, controlling, tracking, and receiving satellite telemetry. Mission support involves supporting logistics, communications, information management, and other personnel infrastructure and sustainment matters so that AFSPACOM personnel can execute their missions.

The AFSPACOM Web site (www.peterson.af.mil/hqafspc) has additional resources describing command operations. These includes the *Crosshairs* column produced by AFSPACOM's commander; news releases (January 2004–present); information on launch operations at Cape Canaveral, Florida, and Vandenberg AFB, California; a photo gallery featuring ICBM launches and satellites; the text of current and archived AFSPACOM base newspapers such as the 21st Space Wing's *Space Observer*, *Space and Missile Times*, *The Missileer*, *Satellite Flyer*, and *Astro News*; along with information about command component organizations such as the 45th Space Wing at Patrick AFB, Florida, the 30th Space Wing AFB, and the 91st Space Wing at Minot AFB, North Dakota. Additional resources include the current *Almanac*, *Air Force Space Command: Strategic Master Plan FY 06 and Beyond* (2003); *High Frontier: The Journal for Space and Missile Professionals* (2004–present); and numerous fact sheets including *Pave Paws Radar System* (n.d.); *Atlas II Launch Vehicle* (2005); *Defense Satellite Communications System* (2005); *Milstar Satellite Communications System* (2005); and *Ground-Based Electro-Optical Deep Space Surveillance* (2006).

National Security Space Institute

The National Security Space Institute (NSSI) is also located at Peterson AFB and was activated on October 18, 2004. NSSI is responsible for providing space education training programs for space staff members and providing instruction on military space systems, space warfare concepts, and space tactical employment. The institute's three schools carrying out this curriculum are the space operations school, space professional school, and space tactics school. Information on NSSI can be accessed at <https://www.peterson.af.mil/nssi/>. Materials available here include listings of institute administrators, a local map showing NSSI's location, admissions information, and course descriptions and schedules. Examples of courses offered include Advanced Course Missile Warning, Counterspace Planning and Integration, Director of Space Forces, Space Fundamentals, Space in the Air and Space Operations Center, Space Operations Course, and Weapons School Preparation Course.

Space and Missile Systems Center

The Air Force Space and Missile Systems Center (SMC) is located in Los Angeles and serves as a technical center responsible for researching, developing, and acquiring military space systems. SMC's work covers space force enhancement, space support, counter-space, force application, and transformation and covers various programs and weapons systems including GPS satellites, the MILSTAR joint-service communications satellite system, the Defense Meteorological Satellite Program, the Space-Based Infrared System (SBIRS), and the Space Tracking and Surveillance System (STSS).

The SMC Web site (www.losangeles.af.mil) provides descriptions of organizational components including the Historian's Office, news releases (1999–present), the newsletter *Astro News* (2001–present), and various resources from the Historian's Office on topics such as the Air Force Satellite Control Network, launch vehicles, satellite systems, and space systems in combat. Numerous fact sheets are also provided including *Most Commonly Asked Questions and Answers on GPS* (n.d.); *Atmospheric Interceptor Technology Program* (1996–1998); *Satellite and Launch Control Systems* (2000); *Space-Based Radar* (2001); *Milstar Satellite Communications System* (2003); *Wide-Band Gap Filler Satellite* (2004); and *Defense Support Program* (2005).



The Schriever Space Complex in Los Angeles is home to the Air Force's Space and Missile Systems Center. (U.S. Air Force)

Air Force Space Battlelab

The Air Force Space Battlelab (AFSB) is located at Schriever AFB near Colorado Springs, Colorado. Established on June 30, 1997, AFSB is responsible for identifying space operations and logistics concepts and rapidly assessing their potential for advancing joint war fighting and Air Force concepts of operations (CONOPS). Key Air Force CONOPS examined by the Battlelab include global strike task force, global response task force, global mobility task force, nuclear response task force, homeland security task force, space command and control, intelligence, surveillance, and reconnaissance task force, and expeditionary air and space force.

AFSB is organized into two team units carrying out its evaluative work. These are the Concept Development Team, which seeks promising ideas or concepts from the Air Force and space communities, along with industry and academia, to review for viability and contributing to Air Force requirements. The Initiative Demonstration Team uses various techniques including prototype demonstrations, modeling and simulation, war gaming, and exercise evaluations to evaluate the military worthiness of promising concepts. The AFSB Web site (www.schriever.af.mil/battlelab) includes a list of frequently asked questions and information about historical and ongoing Battlelab initiatives such as Hyper-spectral Imagery collection upon Pike's Peak, Space Environment Network Display, Space Object Identification in Living Color, Space Tracking of RV Convoys, Infrared Cloud Monitor, Jungle Eyes, which seeks to demonstrate the ability to image targets through canopied jungle foliage using a laser-based imaging sensor mounted on an airborne platform, and Near Earth Object Tracking, which seeks to provide accurate detection and tracking of small objects in low earth orbit.

Air and Space Expeditionary Force Center

The Air and Space Expeditionary Force Center (ASEFC) is a direct reporting unit to the Air Combat Command at Langley AFB, Virginia. ASEFC is responsible for executing Air Force battle rhythm and strives to plan and deliver air and space power to the right place and time to support Air Force mission requirements. It consists of three divisions: Air and Space Expeditionary Operations (AEO), Air and Space Expeditionary Combat Support (AES), and Air and Space Expeditionary Plans (AEP). AEO seeks to integrate all air and space assets for contingency operations in global support of combatant commander requirements by flying units and their direct support personnel with the resources required for deploying in operations ranging from humanitarian assistance to major regional conflicts. AES services all aviation and combat support functional areas dedicated to contingency operations in global support of combatant commander requirements. AEP responsibilities encompass strategic planning, construction, and implementation and oversight of ASEFC cyclical and rotation timelines.

ASEFC does not have its own Web site, but a detailed fact sheet describing its activities can be found on the USAF Web site at www.af.mil/factsheets/.

National Air and Space Intelligence Center

The National Air and Space Intelligence Center (NASIC) is located at Wright-Patterson AFB in Dayton, Ohio. It serves as the national center for integrated intelligence on aerospace systems, forces, and threats. NASIC seeks to produce integrated and predictive air and space intelligence operations to facilitate military operations and the policy-making process and to force modernization. Its ultimate objectives are seeing that U.S. air and space forces are prepared to engage in information operations, defeat future threats, are prepared for global engagement, and are never surprised by foreign air and space capabilities. NASIC's Web site (www.aia.af.mil/units/nasic.asp) features information about center activities, historical information about operations such as acquiring a Mig-29 jet fighter from the Moldovan Air Force, listings of current and historical center commanders, and information on center positions and how to apply for these positions.

North American Aerospace Defense Command

The North American Aerospace Defense Command (NORAD) is a joint U.S.–Canadian organization located in Cheyenne Mountain near Colorado Springs, Colorado. NORAD's mission is providing aerospace warning and control for North America. Aerospace warning is defined as monitoring man-made objects in space and detecting, validating, and warning of attack against North America by aircraft, missiles, or space vehicles utilizing military support arrangements with other military commands. Aerospace control involves ensuring air sovereignty and air defense of U.S. and Canadian airspace.

NORAD's commander is appointed by and responsible to the president of the United States and Canadian prime minister. The commander's headquarters are at nearby Peterson AFB. Cheyenne Mountain maintains a central collection and coordination facility for a worldwide sensor system to provide NORAD's commander and U.S. and Canadian leadership with an accurate picture of any aerospace threat. Subordinate region headquarters at Elmendorf AFB, Alaska; Canadian Forces Base Winnipeg, MB; and Tyndall AFB, Florida receive direction from the commander and control operations in their individual areas of responsibility.

NORAD's Web site (www.norad.mil) provides biographical information about command leaders, news releases (2001–present), a historical overview of U.S. homeland security, instructional material on homeland security including a course syllabus, information on potential employment opportunities, information on potential business contracting

opportunities, descriptions of regional NORAD commands such as the Canadian Region, and a brief organizational history synopsis.

30th Space WingB

The 30th Space Wing is located at Vandenberg AFB, California. This unit is responsible for managing DOD space and missile testing, placing satellites into polar orbit from the West Coast, and using expendable rocket boosters such as the Delta II and Titan IV to carry out its missions. Additional 30th Space Wing activities include West Coast launch activities for the Air Force, NASA, and various private sector contractors. These responsibilities are carried out by the space wing's Operations Group, Mission Support Group, Medical Group, and Launch Group. The 30th Space Wing Web site is located at www.vandenberg.af.mil/. It features wing leader biographies, descriptions of organizational activities, news releases (2003–present), listings and descriptions of unclassified launch missions (April 2002–present), and the current issue of *Space and Missile Times* newspaper.

U.S. Army

The Continental Congress established the American Continental Army on June 14, 1775; the first U.S. Congress established the Department of War on August 7, 1789; and the 1947 National Security Act established the Department of the Army headed by the secretary of the Army. The U.S. Army's mission is organizing, training, and supplying active and reserve land forces to defend the United States. Information about overall army activities can be found at www.army.mil/. The U.S. Army also has an extensive involvement in space warfare and defense activities, which began in the aftermath of World War II to the present. Early Army historical accomplishments in this area include the 1957 creation of the first program office for ballistic missile defense and successfully intercepting an intercontinental ballistic missile on July 19, 1962. Army agencies involved in these activities are profiled below.

Assistant Secretary of the Army–Acquisitions, Logistics, and Technology)

The assistant secretary of the Army (Acquisitions, Logistics, and Technology), ASA (ALT) is responsible for executing the Army's acquisition functions and management systems, overseeing army logistics management functions and operations, executing army research and development functions, directing the Army Science Board, ensuring weapons system production readiness, overseeing the army's industrial base and preparedness programs, and supporting Department of the Army space and strategic acquisition programs. The ASA (ALT) Web site (<https://webportal.saalt.army.mil>) provides information on component organizational entities dealing with acquisition and systems management, policy

and procurement, and research and technology along with information on Army Science Board activities. Procurement and contracting information is also provided along with access to the Army Digital Library, which features numerous publications and handbooks dealing with military acquisitions and logistics matters. Examples of relevant Army Science Board studies accessible through DTIC STINET include *Prioritizing Army Space Needs* (1998), *Technical and Tactical Opportunities for Revolutionary Advances* (2000), and *Directed Energy* (2004).

Army Command and General Staff College

The Army Command and General Staff College (CGSC) is located at Fort Leavenworth, Kansas. CGSC was initially established as the School of Application for Cavalry and Infantry on January 6, 1882, was renamed CGSC in 1947, and received congressional authorization in 1974 to award the master's of military science degree to its graduates. CGSC seeks to educate leaders in professional military values and practices, serve as the key agent for the U.S. Army's Leadership Development Program, develop army doctrinal guidance, and promote and support the growth of military art and science.

General information about CGSC activities and programs can be found at www.cgsc.army.mil/. These resources include information about the college and its educational philosophy, the online catalog for its Combined Arms Research Library, and resources about component organizations such as the Combat Studies Institute, School for Advanced Military Studies, School for Command Preparation, and Schools of Combined Arms and Staff Services.

Relevant publicly accessible publications that can address space warfare and defense issues include articles from the journal *Military Review* (1922–present), and various reports and student theses including *Envisioning Future Warfare* (1995); *Arming the Skies: The Right Time Has Not Arrived* (2000); *A Fork in the Path to the Heavens: The Emergence of an Independent Space Force* (2002); *Determining if Space is an Applicable Component to Intelligence Preparation of the Battlefield for Ranger Operations When Facing Non-Nation-State Adversaries* (2002); *Examination of Intercontinental Ballistic Missile Defense Development Within the United States from 1952 to 1965* (2003); *Space Support: Enabler of the Unit of Employment* (2003); *Service Ownership of the Patriot Missile System: Army or Air Force* (2003); *For Want of a Nail: An Assessment of Global Positioning Satellite Replacement* (2004); *Directed Energy Weapons: Do We Have a Game Plan?* (2004); *Space Control: Is Army Investment Necessary?* (2004); and *Joint Theater Missile Defense in Taiwan: Protecting United States Interests and Friends* (2004).

Army Doctrine Center–Reimer Library

The General Dennis J. Reimer Training and Doctrine Digital Library provides one-stop access to approved army training and doctrinal materials at www.adtdl.army.mil/

and access through the Army Publishing Directorate at www.usapa.army.mil/. However, access to these resources is restricted to .mil domain users. Freely accessible Army training and doctrinal publications are accessible through the Global Security.org Web site at www.globalsecurity.org/military/library/policy/army/fm/ with Army field manuals receiving prominent coverage here. Examples of relevant space warfare and defense field manuals include *FM 100–18: Space Support to Army Operations* (1995); *FM 90–43: Multi-service Procedures for Joint Theater Missile Target Development* (1999); *FM 44–100: U.S. Army Air and Missile Defense Operations* (2000); *FM 100–12: Army Theater Missile Defense Operations* (2000); *FM 3.01–16: Multiservice Tactics, Techniques, and Procedures for Theater Missile Defense Intelligence Preparation of the Battlespace* (2002); and *FM 3.01–85: Patriot Battalion and Battery Operations* (2002).

Army Space and Missile Defense Command

Army Space and Missile Defense Command (SMDC) was created by the Department of the Army on October 1, 1997. SMDC is headquartered in Arlington, Virginia and has satellite operations in locales such as Colorado Springs, Colorado, and Huntsville, Alabama, and serves as the Army's preeminent space and national missile defense organization. Its mission is ensuring that Army war fighters have access to space assets and products to achieve decisive victory with minimum casualties and providing effective missile defense to protect the United States, its deployed military forces, and the forces of U.S. allies. Further information on SMDC activities is available at www.smhc.army.mil/. Accessible resources include descriptions of organizational components such as the Future Warfare Center and the Space and Missile Defense Technical Center, press releases (December 1995–present), a space and missile defense acronyms glossary, *The Eagle* newspaper (February 1998–present), and *Army Space Journal* (Spring 2002–present).

Additional SMDC resources include a series of fact sheets on command research programs and activities with representative examples including *Advanced Measurements Optical Range* (n.d.); *Distributed Imaging Radar Technology* (n.d.); *Future Warfare Center* (n.d.); *High Energy Laser Systems Test Facility* (n.d.); *Joint Awareness Warfighter-Space* (n.d.); *Kill Assessment Program* (n.d.); *Multiple Kill Vehicles* (n.d.); *Space and Missile Technical Center* (n.d.); *Space and Missile Defense Command Test and Evaluation Directorate* (n.d.); *Studies and Analysis Division* (n.d.); and *TRADOC System Manager: Ground-Based Midcourse Defense* (n.d.).

Aviation and Missile Command

The Army's Aviation and Missile Command (AMCOM) is headquartered at Redstone Arsenal, Alabama and is part of the Army's Material Command. AMCOM was formed on October 1, 1997 and its responsibilities include developing, acquiring, fielding, and sus-

taining aviation, vehicle, and unmanned missile systems while ensuring the readiness of these systems with seamless transition to combat operations.

Additional details on AMCOM are provided on its Web site, www.amcom.redstone.army.mil/. Relevant resources include command leader biographies; links to AMCOM organizational component Web sites such as the Command Analysis Directorate, Intelligence and Security Directorate, History Office, and Inspector General Office; business contracting information; employment opportunities; photos of weapons systems such as Theater High-Altitude Air Defense; and news releases (January 1998–present).

Accessible publications include the weekly newspaper *Redstone Rocket* (August 21, 2002–present) and numerous historical publications including *Army Ordnance Satellite Program* (1958); *Development, Production, and Deployment of the Nike Ajax Guided Missile System, 1945–1959* (1962); *History of the Field Army Ballistic Missile Defense System Project, 1959–1962* (1963); *History of the Basic Honest John Rocket System, 1950–1964* (1964); *History of the Redstone Missile System* (1965); *History of the Chaparal/FAAR Air Defense System* (1977); and *History of the Jupiter Missile System* (Declassified 1978) along with additional resources on the historical development and evolution of Army missile defense programs including video Web casts.

Fort Greely–Alaska

This facility, located in Fort Greely, Alaska is an Army facility operating a ground-based midcourse ballistic missile defense system with the 1st Space Brigade and the 100th Missile Brigade being the SMDC units assigned to this location. This facility was formally activated on January 22, 2004, and it is responsible for defending the United States against intermediate and long-range ballistic missile attacks while also providing security and operational control for ground-based interceptors based in Alaska.

An embryonic Web site, www.usarak.army.mil/greely, provides some information on this facility, which will, hopefully, include more detail in the future.

Ronald Reagan Ballistic Missile Defense Test Site

The Ronald Reagan Ballistic Missile Defense Test Site (RTS) is located on Kwajalein Atoll and Wake Island in the Republic of the Marshall Islands in the Pacific Ocean. The test site's mission is supporting ballistic missile testing and space operations, which it has done for nearly 40 years. RTS sensors allow the testing of ballistic missiles and ballistic missile interceptor capabilities. The RTS Web site at www.smdc.army.mil/RTS.html provides additional information on range activities. These include the weekly *Kwajalein Hourglass* (June 4, 1999–present), information on local meteorological conditions, descriptions of space operations activities emphasizing the tracking and surveillance of deep space and synchronous satellites, an overview of RTS meteorological support systems, an

overview of the RTS mission control center, and a description and map of RTS missile launch facilities.

White Sands Missile Range

The White Sands Missile Range (WSMR) is located in south central New Mexico near Las Cruces and just north of El Paso, Texas. WSMR's mission involves offering various testing, evaluation, research, and assessment of various military systems and commercial products. Examples of these services include offering the largest open-air/overland missile-testing range in the hemisphere along with conducting environmental testing and computer modeling of various missile systems.

The WSMR Web site (www.wsmr.army.mil) provides information about the activities of range component organizations such as the Aerial Cable Facility, Electromagnetic Test Facility, High Energy Laser Systems Test Facility, Launch Facilities, and Warhead Testing. Numerous fact sheets are also provided including *Rockets: History and Theory* (n.d.); *High Energy Laser Systems Test Facility* (n.d.); *The Corporal Missile Program* (n.d.); and *White Sands Statistics* (Fiscal Years 1994–present).



A Pershing II battlefield support missile is fired from an erector/launcher vehicle on McGregor Range at White Sands. (*U.S. Department of Defense*)



A team of Vanguard I scientists mount the satellite in the rocket. Conducted by the Naval Research Laboratory, Vanguard was the first American satellite program. (*Naval Research Laboratory*)

U.S. Navy

U.S. Navy institutional origins begin with the October 13, 1775 establishment of the Continental Navy of the American Revolution by the Continental Congress. A Department of the Navy and Office of the Secretary of the Navy were established by statute on April 30, 1798, and the National Security Act Amendments of 1949 established the contemporary Department of the Navy in DOD. The U.S. Navy's mission is protecting the United States by effectively prosecuting sea war including seizing or defending naval bases, supporting all U.S. military forces, and maintaining freedom of the seas.

The Navy's historical involvement with space dates back to World War II's aftermath when the Naval Research Laboratory began probing the upper atmosphere using captured German V-2 rockets. This involvement has continued in the ensuing six decades and is performed in multiple naval facilities described below.

Naval Network Warfare Command

The Naval Network Warfare Command (NETWARCOM) is headquartered in Norfolk, Virginia. It was initially established established on July 12, 2002 as Naval Network and Space Operations Command (NNSOC) through the merger of the Naval Space Command and Naval Network Operations Command whose historical provenance dates

from 1983 for Naval Space Command and 1953 for the Naval Network Operations Command's parent agency. NNSOC was disestablished in 2006 and its functions transferred to NETWARCOM.

NETWARCOM is responsible for operating and maintaining the Navy's global telecommunications, information and space systems, and services to directly support operations, training and education, and providing innovative solutions to war fighters. Its domestic and international facilities and personnel also handle responsibilities in areas such as voice and IP connectivity, ground and space segments for naval satellite communications systems, providing space-related operational intelligence to Navy and Marine Corps forces through tactical communication channels, satellite telemetry and tracking, directly down-linking space tactical data, supporting various theater missile defense requirements, and institutionalizing naval space education through curriculum sponsorship at institutions such as the Naval Postgraduate School and Naval War College. Additional information on NETWARCOM is provided through its Web site, www.netwarcom.navy.mil/. These resources include command leader biographies, news releases, a fact sheet featuring budget information, issues of *Info Domain* magazine (July 2006-present), and publications such as *Naval Network Warfare Command Strategy 2006-2010* (2007), and descriptions of NNSOC training activities.

Naval Postgraduate School

The Naval Postgraduate School (NPS) dates from a 1945 statute making it a fully accredited graduate institution, and it moved to its present location in Monterey, California in 1951. NPS consists of nearly 1,500 students representing officers from U.S. military services and nearly thirty countries and selected U.S. Government employees. These students study and conduct research in areas of interest to the Navy and other DOD entities. Examples of master's and doctoral degrees offered by NPS include national security affairs, aeronautical engineering, astronautical engineering, computer science, meteorology, operations research, and systems management.

The NPS Web site (www.nps.navy.mil) contains recent press releases, information about NPS faculty and their research interests, and links to NPS pedagogical and research centers including the Spacecraft Research and Design Center, Systems Technology Battle Laboratory, Center for Civil-Military Relations, Center for Information Systems Security Studies and Research, The Cebrowski Institute for Innovation and Information Superiority, the NPS Library, Center for Contemporary Conflict, and Center for Joint Services Electronic Warfare.

Additional instructional materials include descriptions for courses such as Space Systems Engineering, Space Systems Operations, Military Applications of Space, Orbital Mechanics and Launch Systems, Air/Ocean Remote Sensing for Interdisciplinary Curricula, Military Satellite Communications, and Launch Vehicle Performance and Selection. Numerous research reports produced by NPS faculty, and in some cases students, are also

accessible on the NPS Web site. Examples include *Computer Aided Thermal Analysis of a Technology Demonstration Satellite (NPSAT1)* (2003); *Unmanned Vehicle Distributed Sensor Management and Information Exchange Demonstration* (2004); *Formal Specification and Run-Time Monitoring within the Ballistic Missile Defense Project* (2005); *Analysis of the Performance Characteristics of the Naval Postgraduate School MWR-O5XP Mobile Weather Radar* (2005); *Trident Warrior Experimentation Process* (2005); and *Measuring Customer and Employee Loyalty at Space and Naval Warfare Systems Center Charleston* (2005).

Naval Research Laboratory

The Naval Research Laboratory (NRL) began operations in 1923 and is headquartered in Washington, D.C. with additional locations nationwide. NRL conducts multidisciplinary research on scientific and technological developments in fields such as physical, engineering, environmental, and space sciences, providing multidisciplinary support to Naval Warfare Centers, and space and space systems technology development and support. NRL also cooperates with its parent organization the Office of Naval Research in coordinating, executing, and promoting Navy and Marine Corps scientific and technology programs through universities, government laboratories, commercial, and nonprofit organizations. Further information about NRL activities can be found at www.nrl.navy.mil/. These resources document NRL accomplishments and include news releases (1996–present), descriptions of organizational entities and their work such as the Naval Center for Space Technology and the Ocean and Atmospheric Science Directorate and that directorate’s Space Science Division, and the Office of Naval Research’s Future Naval Capabilities program. Business contracting information is also provided. Accessible publications include NRL’s *Fact Book* (2004), *Naval Research Laboratory’s Major Facilities* (2005), and *Annual Report* (2005).

Naval War College

The Naval War College (NWC) is located in Newport, Rhode Island and provides graduate education for naval officers. Since its 1884 establishment, NWC’s mission has been enhancing the professional capabilities of its students to make sound decisions in combat, staff, and management positions in naval, joint, and combined environments; provide solid understanding of military strategy and operational art; instill joint attitudes and perspectives; and serve as a research and gaming center to develop advanced strategic, war-fighting, and campaign concepts for future deployment of maritime, joint, and combined forces.

Information about NWC’s multifaceted operations can be found at www.nwc.navy.mil/. These resources include biographies of faculty and descriptions of their research interests, information on college departments such as the Strategy and Policy Department,

National Security Decision Making Department, and Center for Naval Warfare Studies, along with information on library resources, the Naval War College Press, and recent news releases.

Relevant publications accessible on NWC's Web site include articles from the scholarly journal *Naval War College Review* (Autumn 1996–present) and various reports including *Theater Ballistic Missile Defense From the Sea: Issues for the Maritime Component Commander* (1998); *The Limits of Transformation: Officer Attitudes Toward the Revolution in Military Affairs* (2003); *Military Transformation and the Defense Industry After Next: The Defense Industry Implications of Network-Centric Warfare* (2003); *China's Nuclear Force Modernization* (2005); and *Naval Power in the 21st Century: A Naval War College Review Reader* (2005).

Navy Doctrine

The U.S. Navy has a number of doctrinal documents stressing the factors it emphasizes in conducting various naval operations. Naval Department Directives from the secretary of the Navy can be found at <http://doni.daps.dla.mil/> with relevant examples being *SecNav Instruction 5400.39C: Department of the Navy Space Policy* (2004) and *SecNav Instruction 5400.43: Navy Space Policy Implementation* (2005). Additional naval doctrinal publications are produced by the Naval Warfare Development Command (NWDC). Accessible NWDC doctrinal publications are available at www.nwdc.navy.mil with representative samples including *Naval Doctrinal Publication 1: Naval Warfare* (1994), *Naval Doctrinal Publication 6: Naval Command and Control* (1995), and *Navy Warfare Library NTTP 1–01* (2005).

Pacific Missile Range Facility

The Navy's Pacific Missile Range Facility (PMRF) is located at Kekaha, Hawaii on Kauai Island. Its mission is providing integrated range service in a contemporary multi-threat and multidimensional environment, which produces the safe conduct and evaluation of training missions and delivering quality products to improve stakeholder abilities to achieve readiness and other national security objectives. Space, air, and surface tracking of missile launches are provided by PMRF radar sites and underwater communications transducers, and PMRF is linked to additional range and data-processing facilities and is capable of transmitting real-time test and exercise data and video anywhere in the United States due to microwave, fiber-optic, and satellite communication resources.

PMRF's Web site at www.pmr.f.navy.mil/ provides information on the range's mission and physical environment, listings of local support systems and services provided by other federal agencies such as the Naval Undersea Warfare Center, recently implemented range systems upgrades, and information on employment opportunities.

Space and Naval Warfare Systems Command

Space and Naval Warfare Systems Command (SPAWAR) is responsible for supporting U.S. Navy and Marine Corps electronic systems, equipment, C4I, surveillance, and reconnaissance and space systems capabilities.

SPAWAR's Web site (www.spawar.navy.mil) features an organizational chart, command leader biographies, descriptions of organizational components such as the Program Executive Office for C4I and Space, and information on recently awarded business contracts.

Examples of accessible publications include *SPAWAR Instruction 2450.1: Electromagnetic Environmental Effects (E3) Control Within the Space and Naval Warfare Systems Command and Warfare Systems of the Battle Force* (1991); *SPAWAR Instruction 5430.35A: Designation of NAVSTAR Global Positioning System (GPS) Program Office* (1991); *SPAWAR Instruction 3090.1: C4ISR System Criteria for Shipboard Topside Integration* (2003); *Naval Space at the Forefront of Transformation: Bringing New Capabilities to the Joint, National, Naval Warfighter* (2004); *Integrating Interests/Finding Common Ground* (2005); *Kill Chains and Weapons on the Tactical Edge* (2005); and *Program Executive Office C4I Integrated Network Centric Warfare Roadmap* (2005).

