

Foreword

The US National Space Policy released by the president in 2006 states that the US government should “develop space professionals.” As an integral part of that endeavor, AU-18, *Space Primer*, provides to the joint war fighter an unclassified resource for understanding the capabilities, organizations, and operations of space forces.

Historically, the United States has been a world leader in space exploration and use. In 2001, the Commission to Assess United States National Security Space Management and Organization unanimously concluded “that the security and well being of the United States, its allies, and friends depend on the nation’s ability to operate in space.”¹ Recent conflicts and world events continuously demonstrate the importance of space assets and capabilities to our security functions. Our navigation satellites provide instant pinpoint positional and targeting information to aircraft, ground forces, ships, and command centers. These same satellites provide a precise timing source around the world that is critical to maintaining infrastructures, including financial institutions, power grids, cell phones, and even our cable and satellite TV. Communications satellites provide global connectivity between all levels of our national security infrastructure. Weather satellites report meteorological data, better than ever before, in near real time directly to forces in theater. Early warning satellites detect and report missile launches and serve as both strategic and tactical theater warning. These same early warning satellites serve to cue the integrated missile defense system. Finally, the US government conducts satellite photo reconnaissance that includes near-real-time capability, overhead signals intelligence collection, and overhead measurement and signature intelligence collection, which contribute directly to the success of our war fighters.

This primer is a useful tool both for individuals who are not “space aware”—unacquainted with space capabilities, organizations, and operations—and for those who are “space aware,” especially individuals associated with the space community, but not familiar with space capabilities, organizations, and operations outside their particular areas of expertise. It is your guide and your invitation to all the excitement and opportunity of space.

Last published in 1993, this updated version of the *Space Primer* has been made possible by combined efforts of the Air Command and Staff College’s academic year 2008 “Jointspacemindedness” and “Operational Space” research seminars, as well as select members of the academic year 2009 “Advanced Space” research seminar.



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FOREWORD

Note

1. Commission to Assess US National Security Space Management and Organization, *Report of the Commission*, 11 January 2001.

Preface

This is a new beginning. It was 1993 when the predecessor to this document was last published, and much has changed. When we were asked to take on the challenge of updating and preparing the *Space Primer* for publication, we, in retrospect, did not fully understand what we were agreeing to. I, for one, certainly have a newfound respect for published authors. This product is the culmination of literally thousands of hours of work by many Air Command and Staff College (ACSC) students, ACSC faculty members, and the team at Air University Press working directly on this project, as well as many others who helped in some way or another. I am very proud of the dedicated team that contributed so much to making this project happen. They deserve the credit for all that is good in this *Space Primer*.

The purpose of the AU-18 *Space Primer* is to provide an unclassified “one-stop shopping” resource for the space professional and the joint war fighter to better understand the capabilities, organizations, and operations of space forces. We certainly hope you will find this product useful, and where you find errors, we ask that you will both forgive us and help us make this product better during the next revision. There is, no doubt, room for improvement. There was certainly much discussion on what should be included and who the target audience would be. Often it was quite difficult for our team to agree. Imagine trying to write an “air primer” that includes flight dynamics, physics, fighters, bombers, ISR, acquisitions, law, and so forth. That is what we were asked to do with this *Space Primer*, while making it useful for both the “credentialed space professional” and the joint war fighter. For those readers who find fault with the design, scope, or some other area of this product, it may be tempting to think, “I could have done better.” I sincerely hope you do. If the best thing that comes from this publication is a new and better future version of the *Space Primer*, then we, the team that put this version together, will be very pleased. I do hope that it won’t be another 16 years before the next version is published.

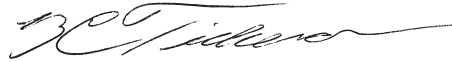
This product is in print due to the dedicated efforts of many people who deserve thanks! We greatly appreciate the support of the following organizations and the many fine individuals who assisted us in these organizations: Air Command and Staff College, Air University Press, the National Space Studies Center, and Air Force Space Command. I want to specifically thank my Air University Press editor, Ms. Demorah Hayes, for her patient guidance and tireless efforts. Without her, this project would likely not have been completed.

For my part, I would like to thank Col Jim Forsyth, USAF, retired, PhD, and Lt Col Jim Parco, USAF, PhD, for their patience and mentoring. During our tenure together at ACSC, they were very generous with their time, despite their many duties and commitments. They instilled in me a passion for education, both teaching and learning. To both of you, I am grateful and hope to continue on the journey you have helped me to begin.

PREFACE

I also wish to thank my wife, Jennifer, for her patience and understanding while I spent many hours working on this project at home, because I couldn't find the time while at work. To any organizations or persons I have inadvertently left out, that responsibility is mine alone; please accept my apologies and my thanks.

If you wish to comment on the *Space Primer* or suggest revisions for future editions, please send your feedback to AU18-updates@afspc.af.mil.



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List of Contributors

Air Command and Staff College

Academic Year 2008 Students

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Maj Edward "Ed" Chatters IV, USAF	Space Developmental Engineer
Maj Brian "Flash" Crothers, USAF	Space Developmental Engineer
Maj Bryan "Troll" Eberhardt, USAF	Communications and Information
Maj Brian Garino, USAF	Intelligence
Maj Jane Gibson, USAF	Space and Missile Operations
MAJ Kenneth "Ken" Kemmerly, USA	Communications and Information
Maj Christopher "Chris" King, USAF	Space and Missile Operations
Maj Jeffrey "Jefe" Lanphear, USAF	Space and Missile Operations
Maj Gabriel "Gabe" Medina, Dominican Republic Air Force	Mobility Pilot
LCDR Jeremy Powell, USN	Surface Warfare
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Maj Sean P. Boles (BS, aerospace engineering, US Naval Academy, Annapolis, MD; MBA, aeronautical and aviation business management, Embry-Riddle Aeronautical University, Daytona Beach, FL) is a faculty instructor and advisor on US armed forces, joint campaign planning and execution, air operations centers, and the Defense Intelligence Agency at Air Command and Staff College (ACSC), Air University. He instructs select international and US field grade officers and DOD civilians in the operational art of applying contemporary air and space power in support of US national objectives. Major Boles enlisted in the Navy and completed Machinist Mate "A" School, Naval Nuclear Power School, and the Navy Nuclear Power Prototype School, receiving top honors in 1989. After being assigned to the ballistic nuclear submarine, USS *Henry M. Jackson* (Fleet Ballistic Missile Submarine 736), Bangor, WA, he attended the Naval Academy. Upon graduation, Major Boles was commissioned in the Air Force on 29 May 1996 by an interservice exchange program. His career includes assignments as space and missile officer for Peacekeeper Intercontinental Ballistic Missile (ICBM) system, a mission planner and flight commander for the Defense Meteorological Satellite Program, and the project manager of proof-of-concept WindSat Coriolis Satellite Program for the National Polar-Orbiting Environmental Satellite System (NPOESS) Integrated Program Office. He was a core member of the Commander's Action Group, which included the Twentieth Air Force commander's executive officer, the chief, Current Operations, and deputy chief, Missile Operations at Headquarters (HQ) Twentieth Air Force. Major Boles is also a graduate of the Squadron Officer School (SOS) and ACSC.

Maj Edward P. Byrne (BS, aerospace engineering, State University of New York at Buffalo; MBA, Webster University, Los Angeles AFB, CA; master of military operational art and science [MMOAS], ACSC, Maxwell AFB, AL) was commissioned through Officer Training School (OTS) in May 1996. Major Byrne currently serves as flight commander for radar development and integration, Hanscom AFB, MA. His career includes assignments as chief, Satellite Command and Control Systems Modification Branch, Space and Missile Systems Center, Operating Location AO at Onizuka AFS, CA; flight commander and chief, Spacecraft Systems Branch, Operating Division 4 at Onizuka AFS, CA; chief, Delta II Mission Management, Space and Missile Systems Center at Los Angeles AFB, CA; and chief, Space and Launch Development Segment at the National Reconnaissance Office, Chantilly, VA. Major Byrne is also a resident graduate of SOS and ACSC.

Maj Burton H. Catledge (BA, speech communications, University of Northern Colorado, Greeley; MS, human resource management, Troy University, Malmstrom AFB, MT) is currently a student at ACSC. Major Catledge entered the Air Force in 1995. His career includes assignments as an ICBM crew commander, missile warning flight commander, 35th Fighter Wing chief of operational plans, and Pacific Air Forces chief of special technical operations. Major Catledge is also a resident graduate of SOS and the Air Force Weapons School.

Maj Edward P. Chatters IV (BS, aerospace and astronautical engineering, Auburn University, AL; MS, computer information systems, University of Phoenix, AZ) is currently the military assistant to the deputy assistant secretary of the Air Force for science, technology, and engineering at HQ US Air Force, Washington, DC. Major Chatters enlisted in the Marine Corps as an infantryman in 1993, received a commission in

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1996, and served as a field artillery officer with the 1st Battalion, 10th Marine Regiment, 2nd Marine Division and subsequently as the operations officer of HQ and Support Battalion, Marine Corps Base, Camp Lejeune, NC. He transferred to the Air Force in November 2000 to work as a developmental engineer at the Air Force Research Laboratory (AFRL), Space Vehicles Directorate at Kirtland AFB, NM. Major Chatters' career includes assignments as an artillery platoon commander, target information officer for the 24th Marine Expeditionary Unit, battalion operations officer, lead engineer for spacecraft component technology team, deputy chief of the Space-Based Infrared Technology Branch, executive officer of AFRL Phillips Research Site, and orbital analyst and flight commander for the 1st Space Control Squadron, Cheyenne Mountain AFS, CO. Major Chatters is also a resident graduate of SOS and ACSC.

Maj Brian J. Crothers (BS, electrical engineering, Virginia Military Institute, Lexington; MS, electrical engineering, Air Force Institute of Technology (AFIT), Wright-Patterson AFB, OH) is currently a faculty instructor at ACSC, following his graduation as a student at the school. Major Crothers was commissioned in the Air Force in 1995. He has served previously as chief engineer for 25th Space Control and Tactics Squadron. Prior to that assignment he was a flight commander in the 36th Electronic Warfare Squadron, responsible for the electronic warfare reprogramming of F-16 and A-10 electronic warfare equipment. Before that he was flight commander, Test Support Flight, in the 346th Test Squadron, Air Force Information Warfare Center. There he supported electronic warfare effectiveness assessments for Compass Call and EA-6B Prowlers during Red Flag/Green Flag exercises and provided radio frequency vulnerability and emissions control assessments for a variety of other customers. Major Crothers was selected to attend the in-residence engineering program at AFIT as a 4IBY (specializing in electromagnetic field theory). His initial assignment was as a human factors engineer working on helmet-mounted cueing systems.

Maj Bryan T. Eberhardt (BS, computer science, Virginia Military Institute, Lexington; MA, international relations, Oklahoma University, Ramstein AB, Germany) is the commander of the 8th Communications Squadron, Kunsan AB, Republic of Korea. Major Eberhardt entered the Air Force in 1996. His career includes assignments as a program control manager for the Global Air Transportation and Execution System for Air Mobility Command's Computer Systems Squadron; an executive officer for the 631st Air Mobility Support Squadron; command and control systems flight commander for the 751st Communications Squadron at Osan AB, Republic of Korea; a current operations cell chief, war planner, and career field manager for the US Air Forces in Europe Communications and Information Directorate at Ramstein AB, Germany; and a network services flight commander and deputy commander in the 1st Communications Squadron at Langley AFB, VA. He has deployed as chief of current operations for the Combined Air Forces-North Communications and Information Directorate at Incirlik AB, Turkey, during Operation Iraqi Freedom (OIF) and was an infrastructure planner for Combined Joint Task Force 76 at Bagram AF, Afghanistan, in support of Operation Enduring Freedom (OEF). Major Eberhardt is also a resident graduate of SOS and ACSC.

Maj Brian W. Garino (BS, aviation management, flight technology, Florida Institute of Technology, Melbourne; MAS, aeronautical science, Embry Riddle Aeronautical University) is director of operations, 314th Training Squadron, Monterey, CA. Major Garino was commissioned via OTS in 1996. His career includes assignments as a squad-

ron intelligence officer for a KC-135 squadron, counterterrorism officer at USCENTCOM, wing intelligence officer at McChord AFB, and executive officer for the J2 at US Joint Forces Command. Additionally, he completed an internship at the Defense Research Project Agency in 2006. He has deployed numerous times in support of Operations Northern Watch, Southern Watch, Allied Force, Enduring Freedom, and Iraqi Freedom.

Maj Jane E. Gibson (BS, biology, Air Force Academy, Colorado Springs, CO; MMOAS, ACSC, Maxwell AFB, AL) is the deputy, Operational Support and Sustainment Division SY/OS, Space Superiority Systems Wing, Space and Missile Systems Center, Los Angeles AFB, CA. The Space Superiority Systems Wing is responsible for equipping the joint war fighter with unrivaled offensive and defensive counterspace, space situation awareness, and special access required (SAR) capabilities required to gain, maintain, and exploit space superiority. Major Gibson entered the Air Force in 1994. Her career includes assignments as a deputy missile combat crew commander, missile combat crew commander and chief, Weapons and Tactics Codes Training at Malmstrom AFB, MT; orbital analyst and space control analyst at Cheyenne Mountain AFS, CO; and counterspace threat analyst and HQ squadron section commander at the National Air and Space Intelligence Center, Wright-Patterson AFB, OH. Major Gibson is a resident graduate of SOS and ACSC.

Lt Col Winston Gould (BS, business administration, Baptist College at Charleston, SC; MAS, aviation operations and management, Embry-Riddle Aeronautical University, Malmstrom AFB, MT; MMOAS, ACSC, Maxwell AFB, AL) currently serves as an airborne strike advisor, US Strategic Command (USSTRATCOM) Airborne Command Post, J317, Offutt AFB, NE. He previously served as the director of staff for the Department of International Security and Military Studies at ACSC. His deployment experience includes an assignment as a strategic policy planner with the Strategic Plans and Policy Directorate, Combined Forces Command—Afghanistan, in Kabul (OEF). Prior to his assignment to ACSC, he served as an airborne launch control system/intelligence planner instructor/evaluator aboard the E-6B Mercury aircraft. He has also served as the course chairman for the Information Warfare Applications Course, as an emergency war order planner for the 341st Missile Wing, and in various crewmember assignments, including senior instructor crew commander for the Minuteman III/CDB (Deuce) weapon system. Lieutenant Colonel Gould is a command ICBM operator with 168 Minuteman III/CDB alerts, 24 USSTRATCOM ground alerts, and 1,300 hours in the E-6B Mercury airframe. He is also a resident graduate of SOS and ACSC and a nonresident graduate of Air War College (AWC).

MAJ Kenneth G. Kemmerly (BA, criminology, Saint Leo University, Saint Leo, FL; MS, information technology management, Touro University International, Los Alamitos, CA; MMOAS, ACSC, Maxwell AFB, AL) is the J6, Joint Task Force Paladin, Joint Improvised Explosive Device Defeat Organization (JIEDDO), Afghanistan. Major Kemmerly is an Army signal officer who was commissioned by the Officer Candidate School in 1994. His career includes assignments as a signal platoon leader, signal company commander, brigade S6, observer controller/trainer, and command, control, communications, computers, and intelligence (C4I) combat developer for the Army's Future Combat Systems program. Major Kemmerly's military education includes Signal Officer Basic and Advanced Courses, Branch Automation Course, Airborne School, Combined Arms and Services Staff School, and ACSC.

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