

Air War College – AY23 Spacepower Course Syllabus

SP6950 Spacepower

Fall 2022

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Course Objective

The Spacepower course provides an in-depth understanding of spacepower. Students are provided the necessary foundations on the different components of spacepower to think strategically about contemporary space policy.

Desired Learning Outcomes

After completing this course, students should be able to:

- Analyze the growth of American spacepower and the organizations, technology, and theories developed to improve its employment.
- Appraise the major spacepower theories, considering each one's utility to accomplish national goals as well as their view of the nature of national power from space.
- Evaluate the place of theory and its role in spacepower, especially regarding strategy development.

Required Texts

- Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age*, (Baltimore, MD: The Johns Hopkins University Press 1985).
- Deganit Paikowsky, *The Power of the Space Club*, (New York, NY: Cambridge University Press).
- Bleddyn E. Bowen, *War in Space: Strategy, Spacepower, Geopolitics*, (Edinburgh, UK: Edinburgh University Press 2020).
- Richard A. Muller, *Physics for Future Presidents: The Science Behind the Headlines*, (New York, NY: W.W. Norton & Company 2008).
- Daniel Deudney, *Dark Skies: Space Expansionism, Planetary Geopolitics, and the Ends of Humanity*, (New York, NY: Oxford University Press 2020).
- Michael J. Neufeld, *Spaceflight: A Concise History*, (Cambridge, MA: MIT Press 2018).

Deliverables and Assessment

Seminar Contribution - 15%

Your success in this course depends on careful preparation for and active engagement in seminar discussions. You are expected to read and study all assigned materials, come to class prepared to contribute to the seminar, and engage in thoughtful and critical discussion with your classmates and instructor.

Student Briefs – 15%

Each student in the course will choose a topic from one IP on which to brief the class. After IP1, students will choose which of the IPs they would like to brief to the class. Students will have 10-15 minutes to deliver the brief. Students are expected to use slides in delivering their presentation. The **briefs will not be based on the readings**, but will instead provide a student's perspective on a given topic. These perspectives will be informed by outside research and/or a student's professional experience. This assignment is not intended to be onerous, but students should expect to spend one to two hours on research and preparation. Students may supplement this with their own professional experience or knowledge of the topic. Content for the brief should include: 1) a brief overview of a given topic; 2) contemporary policy issues or debates related to that topic; 3) questions you have about a given topic. Following the brief, the presenter will take questions from the class for 5-10 minutes about their topic. Student performance will be assessed by the quality of the analysis and the student's presentation skills. Depending on the class, these briefs will take place at different times (for example, sometimes at the beginning of class, other times at the end of class). Presenters should coordinate with me prior to their presentation.

Reading Responses– 35%

Throughout the course, students will **write three reading response papers, choosing among the course IPs**. Response papers will correspond to readings from one of the IPs. Most importantly, these response papers **should not simply summarize the readings**. These responses serve a couple of functions. They require that students engage deeply and critically with the course material and they develop the habit of writing. Your response papers should make an argument that critically assesses the week's readings/videos. Please note that critical analysis is not simply criticizing a piece but instead involves carefully evaluating both its strengths and weaknesses (based on its logic and evidence). You may also write how a piece could be improved, questions raised, or unifying themes across the readings. These responses should cover multiple readings/videos, but they do not need to cover all the readings from the IP. **Your response papers should be at least one page single-spaced**. Response papers will be submitted no later than midnight the night before class (though preferably much earlier). As you only have to write three response papers, please plan ahead accordingly to allow yourself enough time to finish the response paper. Responses will be assessed on the quality of the analysis/argument, writing clarity, and grammar.

Final Paper – 35%

Final assessment for the Spacepower course will be a comprehensive examination of the concepts presented throughout the course. I will announce the final essay topics one month before the final due date. The final essay should be anywhere between 3-4,000 words long. Answers will draw on course material, though students are welcome to include outside sources. The answers should make a clear argument that is supported by evidence. Answers should not simply summarize readings from the course, but they should instead critically engage with the course material and advance an argument.

JOURNALS, WEBSITES/ORGANIZATIONS, AND PODCASTS

For additional resources for learning about spacepower and security, please check out the following journals, websites, and podcasts.

Journals:

Space Policy
Astropolitics
Acta Astronautica
Intelligence and National Security Journal
Journal of Cold War History
Journal of Strategic Studies
Strategic Studies Quarterly
International Security
Security Studies
The Center for Space Policy and Strategy/The Aerospace Corporation

Websites/Organizations/Blogs:

United States Space Force
UNOOSA
Secure World Foundation
Space News
The Space Review
Aerospace Security (Center for Strategic and International Studies)
SpaceWatch.Global
Air Force Magazine
The Space Show
Defense News
Center for Naval Analysis
Rand Corporation
China Aerospace Studies Institute
Air and Space Magazine
Carnegie Endowment for International Peace
National Air and Space Museum

War on the Rocks
Foreign Affairs
Bulletin of Atomic Scientists
The Diplomat
Foreign Policy Magazine
Wired
Parabolic Arc

Podcasts:

Space Junk
Moonstruck
A Political History of Apollo
Dongfang Hour

COURSE AND INSTRUCTIONAL PERIOD SCHEDULE

6950-1 – Course Introductions, Orbital Mechanics Pt.1 (July 29)

Guest Speaker: Col. Kirk Johnson

Required: (0 pages; 2 hours 3 minutes of videos)

- Read the course syllabus
- Watch the following videos:
 - a) The Aerospace Corporation, “The Physics of Space War”:
<https://www.youtube.com/watch?v=SmFb-4KVG4M>
 - b) NSSI, “Launch, Propulsion, and Re-Entry”:
<https://www.youtube.com/watch?v=5n2Px6hCvtg>
 - c) NSSI, “Space Mission Operations”:
<https://www.youtube.com/watch?v=5n2Px6hCvtg>
 - d) NSSI, “Space Environment”: <https://www.youtube.com/watch?v=LIqPxnoprqY>
 - e) NSSI, “Spacecraft Subsystems”:
https://www.youtube.com/watch?v=iXRjHp_p1n4
 - f) NSSI, “Electromagnetic Spectrum Basics”:
<https://www.youtube.com/watch?v=4r59CaLhVNY>
 - g) NSSI, “2-Body Equation of Motion”:
<https://www.youtube.com/watch?v=QrnTqefMNp8>
 - h) NSSI, “Orbit Types”: <https://www.youtube.com/watch?v=Bvj1BpP4zU8&t=93s>
 - i) NSSI, “Classical Orbital Elements (COEs)”:
<https://www.youtube.com/watch?v=2gAYqtmNJx8>
 - j) NSSI, “Conservation of Energy & Momentum,”
https://www.youtube.com/watch?v=4LbFqyM-j_A
 - k) NSSI, “Gravity”: <https://www.youtube.com/watch?v=0mFEtdBvZcw>
 - l) NSSI, “Newton’s Laws”: <https://www.youtube.com/watch?v=04QjjnozgvC>
 - m) NSSI, “Kepler’s Laws”: <https://www.youtube.com/watch?v=djgPfNrEkp0&t=2s>

6950-2 – Orbital Mechanics Pt.2 (August 2nd)

Guest Speaker: Col. Kirk Johnson

Required Reading (102 pages)

- Richard A. Muller, *Physics for Future Presidents: The Science Behind the Headlines*, (New York, NY: W.W. Norton and Company 2008). Part IV, Ch.15-18 (191-245)
- Jeff Becker, “A Starcruiser for Space Force: Thinking Through the Imminent Transformation of Spacepower,” *War on the Rocks*, May 19, 2021: <https://warontherocks.com/2021/05/a-starcruiser-for-space-force-thinking-through-the-imminent-transformation-of-spacepower/>
- Rebecca Reesman and James Wilson, “Physics Gets a Vote: No Starcruisers for Space Force,” *War on the Rocks*, June 28, 2021: <https://warontherocks.com/2021/06/physics-gets-a-vote-no-starcruisers-for-space-force/>
- Rebecca Reesman and James R. Wilson, “The Physics of War in Space: How Orbital Dynamics Constrain Space-to-Space Engagements,” *The Aerospace Corporation*, October 2020. (1-20)

6950-3 – International Relations Theory and Outer Space (August 5th)

Lecture: Dr. Lincoln Hines

Required Readings: (89 pages)

- Deganit Paikowsky, *The Power of the Space Club*, (New York, NY: Cambridge University Press 2017), Ch.1,3 (1-28; 48-74)
- Jack Snyder, “One World, Rival Theories,” *Foreign Policy*, October 26, 2009 (15 pages)
- David A. Lake, “Theory is dead, long live theory: The end of the Great Debates and the rise of eclecticism in International Relations,” *European Journal of International Relations*, 19, no.3 (2013), 567-587.

6950-4 – Spacepower Theory (August 18th)

Guest Lecture: Dr. Everett Dolman

Required Readings (138 pages)

- What Place for Space: Competing Schools of Operational Thought in Space (24 pages)
- Totem and Taboo (24 pages)
- Bleddyn Bowen, *War in Space: Strategy, Spacepower, Geopolitics*, (Edinburgh, UK: Edinburgh University Press 2020), Introduction (1-16), Ch.2 (54-102)
- Dwayne Day, “The Helium-3 Incantation,” *The Space Review*, September 28, 2015: <https://www.thespacereview.com/article/2834/1> (6 pages)
- Peter Garretson, “Space Force’s Jupiter Sized Culture Problem,” *War on the Rocks*, July 11, 2019: <https://warontherocks.com/2019/07/space-forces-jupiter-sized->

[culture-problem/](#) (12 pages)

- Peter Garretson, “A Historic National Vision for Spacepower,” *War on the Rocks*, September 9, 2019: <https://warontherocks.com/2019/09/a-historic-national-vision-for-spacepower/> (8 pages)

6950-5– Background on the Space Age (August 23rd)

Guest Lecture: Dr. Samantha Taylor and Dr. Mike Pavelec

Required Readings pages:

- Michael J. Neufeld, *Spaceflight: A Concise History*, MIT Press, Ch.1-3, 1-71.
- Walter McDougal, *The Heavens and the Earth: A Political History of the Space Age*, (Johns Hopkins University Press, 1997), pp. 3-13, 17-19, 20-40 (skim), 41-62 (skim), and 63-65.
- Michael Neufeld, “Wernher von Braun’s Ultimate Weapon,” *Bulletin of Atomic Scientists*, July/August 2007, 50-57.

6950-6– Space Policy & National Security Space (September 12th)

Guest Lecture: Michael Gleason

Required Readings (87 pages)

- A Space Policy Primer: Key Concepts, Issues, and Actors (25 pages)
- Joint Publication (JP) 3-14, Space Operations (III-1 to III-9).
- Defense Space Strategy Summary (pages 1-10).
- Space Capstone Publication on Space Power (pages 16-26).
- Chief of Space Operations’ Planning Guidance (pages 1-11).
- Never a Day Without Space: Commander’s Strategic Vision (pages 1-10).

6950-7– Deterrence, Escalation, and Warfighting (September 26th)

Lecture: TBD

Required Readings (72 pages; 92 minutes, 46 seconds of videos)

- Defense Against the Dark Arts in Space: Protecting Space Systems from Counterspace Weapons (39 pages)
- How China Loses the Coming Space War (Pt.1, Pt.2, and Pt.3) (15 pages)
- How China “Wins” a Space War,” (12 pages)
- Getting the Most Deterrent Value from U.S Space Forces (6 pages)
- Zack Cooper and Thomas G. Roberts, “Deterrence in the Last Sanctuary,” *War on the Rocks*,
- Jim Cooper, “Updating Space Doctrine: How to Avoid World War III,” *War on the Rocks*, July 23, 2021: <https://warontherocks.com/2021/07/updating-space-doctrine-how-to-avoid-world-war-iii/>

- Aaron Bateman, “Restraint, Not Superiority, In Space,” *War on the Rocks*, March 4, 2021: <https://warontherocks.com/2021/03/restraint-not-superiority-in-space/>
- Todd Harrison, Zack Cooper, Kaitlyn Johnson, and Thomas G. Roberts, “Escalation and Deterrence in the Second Space Age,” *Center for Strategic and International Studies*, October 2017, 19-42, <https://warontherocks.com/2021/03/restraint-not-superiority-in-space/>
- “Deterrence 101 Module 1—Foundations of Deterrence,” CSIS, Video: https://www.youtube.com/watch?v=g1th_3vILd4 (28:44)
- “Deterrence 101 Module 2 – Theories of Nuclear Use,” CSIS, Video: <https://www.youtube.com/watch?v=BTedg2Ya0ZQ> (31:08)
- “Deterrence 101 Module 3 – Strategic Stability, Escalation, and Crisis Management,” CSIS, Video: <https://www.youtube.com/watch?v=NQiuACUggtg&t=580s> (32:56)

6905-8 – Civil & Commercial Space (October 4th)

Guest Lecture: Mr. Gary Henry, SpaceX

Required Readings (58 pages)

- National Aeronautics and Space Administration, The Artemis Plan: NASA’s Lunar Exploration Program Overview. September 2020. 8-31. (23 pages)
- National Aeronautics and Space Administration, The Artemis Accords: Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for Peaceful Purposes. October 13, 2020. 1-7 (7 pages)
- National Academy of Public Administration, Space Traffic Management: Assessment of the Feasibility, Expected Effectiveness, and Funding Implications of a Transfer of Space Traffic Management Functions, Academy Project Number: 102252 (Washington D.C.: National Academy of Public Administration, August 2020), 1-5. (5 pages)
- Morin J., Wilson R., *Leveraging Commercial Space for National Security*, Center for Space Policy and Strategy, November 2020. 1-9. (9 pages)
- Svetla Ben-Itzhak, “Companies are Commercializing Outer Space: Do Government Programs Still Matter?” *The Washington Post*, <https://www.washingtonpost.com/politics/2022/01/11/companies-are-commercializing-outer-space-do-government-programs-still-matter/>.
- Matt Weinzierl and Mehak Sarang, “The Commercial Space Age is Here,” *Harvard Business Review*, February 12, 2021. <https://hbr.org/2021/02/the-commercial-space-age-is-here>
- Greg Autry and Steve Kwast, “America is Losing the Second Space Race to China,” *Foreign Policy*, August 22, 2019: <https://foreignpolicy.com/2019/08/22/america-is-losing-the-second-space-race-to-china/>
- Ch.4 “Making China Rich: China’s Views on Commercial Space and Space Natural Resource Extraction,” in Kevin Pollpeter, Timothy Ditter, Anthony Miller, and Brian Waidelich, “China’s Space Narrative; Examining the Portrayal of the US-China Space Relationship in Chinese Sources and Its Implications for the United States,” *China Aerospace Studies Institute* (29-53):

<https://www.airuniversity.af.edu/Portals/10/CASI/Conference-2020/CASI%20Conference%20China%20Space%20Narrative.pdf?ver=FGoQ8Wm2DypB4FaZDWuNTQ%3D%3D>

- Neel V. Patel, “China’s Surging Private Space Industry is Out to Challenge the US,” *MIT Technology Review*, January 21, 2021: <https://www.technologyreview.com/2021/01/21/1016513/china-private-commercial-space-industry-dominance/>

6950-9– Arms Control and International Space Law (October 13th)

Guest Lecture: Dr. Andrea Harrington

Required Readings (75 pages):

- Space Law: United Nations Instruments
 - Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space (p. 45)
 - Outer Space Treaty (p. 3)
 - Rescue and Return Agreement (p. 10)
 - Liability Convention (p. 14)
 - Registration Convention (p. 24)
 - Moon Agreement (p. 30)
- The New Space Race: Governing the New Space Race
- International Law and Security in Outer Space: Now and Tomorrow
- Reconsidering Arms Control Orthodoxy (18 pages)
- Enhancing Space Security: Time for Legally Binding Measures
- How to Avoid a Space Arms Race (4 pages)

6950-10– Offense-Defense Balance and Arms Races (October 18th)

Lecture: TBD

Required Readings (70 pages)

- Brad Townsend, “Strategic Choice and the Orbital Security Dilemma,” *Strategic Studies Quarterly*, Vol.14, No.1 (Spring 2020), 64-90 (27 pages)
- Brad Townsend, “Not All Space Capabilities Should Reside in Space Force,” *Space News*, December 24, 2020. <https://spacenews.com/op-ed-not-all-space-capabilities-should-reside-in-space-force/> (5 pages)
- Stephen Van Evera, “Offense, Defense, and the Causes of War,” *International Security* 22/4 (Spring 1998): 5-43. (38 pages)

JOINT OPERATIONS

6950-11 – Airpower – (November 1st)

Bill Lewis, Col, USAF (Ret.)

Required Readings/Video (29 pages; 7 minutes and 47 seconds of video)

- DoDI 5100.01, pages 38-39, paras 6a and 6b (1 page)
- AFDP 1, pages 2-3 and 6-10 (7 pages)
- U.S. Air Force “Agile Combat Employment,” *Air Force Doctrine Note 1021*, December 1, 2021: https://www.doctrine.af.mil/Portals/61/documents/AFDN_1-21/AFDN%201-21%20ACE.pdf (12 pages)
- Untethered Operations, pages 17-25 (9 pages)
- Slaughterbots (video), Available at <https://www.youtube.com/watch?v=9CO6M2HsoIA>. (7 minutes and 47 seconds)

6950-12– Landpower (November 7th)

Lecture: Col. Glenn Schmick

Required Readings/Videos (64 pages, 13 mins)

- Army Multi-Domain Operations, Chief of Staff Paper #1”, pages 1–35 (30 pages).
- The Army in Military Competition, Chief of Staff Paper #2, pages 1 – 29.
- Could This Picture Show How the Army Could Sink China’s Warships?” (4 pages).
- Defense Flash News: US Army’s Sensor to Shooter process and Long-Range Precision Fires Cross Functional Team [Video file]. : <https://www.youtube.com/watch?v=RRPDV1mmGUQ> (2:58).
- Defense Update: Precision Strike Missile (PRSM) To Have Anti-Ship Role! Chinese Navy on its Target [Video file]. (2020, September 15): <https://www.youtube.com/watch?v=oylo3Jsq-p4> (10:18).

6950-13– Seapower – (November 10th)

Capt. Casey Baker

Required Readings/Videos (59 pages, 20 mins)

- Discussion of the Elements of Sea Power, pages 25-29 (4 pages).
- Theory of the Object-Command of the Sea and Defensive Feet Operations- ‘A Fleet in Being’, pages 87-91, 211-215 (7 pages).
- Introduction-The Elements of Sea Power, pages 1-9 (8 pages).
- Admiral of the Fleet S. G. Gorshkov”, pages 68-74 (8 pages).
- On Maritime Strategy, pages 123-129 (6 pages).
- NDP-1, Naval Warfare, pages 1-14, 21-25, 33-35 (19 pages).
- Advantage at Sea: Prevailing with Integrated All-Domain Naval Power, Chp. II & III, 7-14 (7 pages).

- NWC Talks: Great Responsibility Demands a Great Navy - James Holmes [Video file]: https://youtu.be/gSGz1y_W1AE (9:53).
- NWC Talks: Understanding China's Maritime Strategy with James Holmes [Video file]: <https://youtu.be/-zqguIwSn8U> (10:14).

6950-14 – Cyberpower, The Information Environment (November 16th)

Lecture: Dr. Joshua Sipper

Required Readings (48 pages)

- Information Operations, Chapters I, II, and IV (22 pages)
- Cybersecurity and the New Era of Space Activities (10 pages)
- Information Warfare: Issues for Congress (16 pages)

6950-15 – Joint All-Domain Operations (November 21st)

Lecture: TBD

Required Readings (68 pages)

- AFRD 3-99, DAF Role in JADO (23 pages)
- Space Capstone Publication, pages 17-19 “War’s Modern Character” (2 pages)
- Gen. Hyten on The New American Way of War: All-Domain Operations (5 pages)
- Joint Publication 3-14 Space Operations (Chapters II, III, IV) (34 pages)
- Ian Reynolds, “Seeing, Knowing, and Deciding: The Technological Command Dream That Never Dies,” *War on the Rocks*, July 13, 2022: <https://warontherocks.com/2022/07/seeing-knowing-and-deciding-the-technological-command-dream-that-never-dies/> (14 pages)

6950-16– Dark Futures (November 29th)

Required Readings (104 pages; Video 1 minute 33 seconds)

- Russia, Once a Space Superpower, Turns to China for Missions: <https://www.nytimes.com/2021/06/15/world/asia/china-russia-space.html> (7 pages)
- Daniel Deudney, *Dark Skies: Space Expansionism, Planetary Geopolitics, and Ends of Humanity*, (New York, NY: Oxford University Press 2020). Ch.1-2, 5 (3-64, 145-181)
- “What You Need to Know About Nuclear Entanglement,” Carnegie Endowment for International Peace, (1 minute 33 seconds): <https://carnegieendowment.org/programs/npp/nuclear-entanglement>