



Charles University, Faculty of Social Sciences

Institute of Political Studies, Department of International Relations

With the support and co-sponsorship of the Prague Security Studies Institute

Course:	SPACE SECURITY (IN THE 21ST CENTURY)
Semester:	Fall 2016
Teachers:	Mgr. Nikola Schmidt, Ph.D. + three international guest speakers
Form of study:	daily study / English language
Number of students:	25
Credits:	6(7)

Annotation

This course is designed to explore the security dimensions of space from policy, regulatory and technical perspectives, with an emphasis on the irresponsible or disruptive actions of some space-faring nations in this domain and natural hazards for space operations. The course is prepared from the perspective of strategic studies and is consistent with other courses from this security-minded vantage point.

Course Goals

The central objective of this course is to introduce the rapidly growing importance of the field of space security. Among the questions raised early on will be how the security and defense policies of leading world powers influence outer space activities. The course will also probe why it is increasingly urgent to ensure the integrity, availability and reliability of space assets and access to them. The dual-use nature of space technologies (i.e. both for civilian and security/military applications), the explosion of private sector space operators (e.g. in the area of nanosatellites), Western defense requirements and the counterspace measures of global bad actors need to be better understood if civilian space activities are to prosper in the long term. It is also to address how Western supremacy in outer space activities involving security and defense is to be maintained (e.g. the use of satellite communications, Earth observation/meteorology, navigation, weather forecasting, environmental and climate change monitoring, disaster management, missile defense, early warning, space situational awareness, etc.).

Space assets are vulnerable and exposed to a multitude of hazards and threats. Such hazards have natural or man-made origin and include space weather, orbital debris, various technical issues (e.g. satellite malfunctions, unintentional interference, and inaccurate orbital prediction) and in the long term topics such as planetary defense from asteroids and comets, or space resource management. Space debris is the main contributor to what is now often referred to as "congested space". There are also threats posed by the purposeful interference with, or even destruction of, satellites and spacecraft by different types of anti-satellite (ASAT) weapons deployed by some space-faring states.

These kinds of natural and man-made perils are the basis for space security policies, together with the dynamic interplay between terrestrial and space security. This topic should make for lively student classroom discussions. Students will be provided with an overview of the space security portfolio. They will learn about the technologies enabling access to, and operations in, space, how to differentiate between natural and man-made threats from a policy perspective, and the profound geopolitical consequences of any deliberate degradation, disruption, or destruction of space systems and assets.

Students will understand the rather complex link between civilian and military space programs, the current international legal framework that governs space activities, and gain a sense of the short- and medium-term objectives of select national space security communities in the West as well as those of Russia and China.

Workload and Evaluation

40%	Group study (group assessment)	Overall evaluation:
-	One policy paper	>85% – excellent
-	Presentation of the study	75-84% – very good
40%	Project Chapter (5-10 pages) (individual assessment)	61-74% – good
20%	Active participation	<60% – fail

Policy paper, mid-term presentation, final defense and the chapter of the project are based on the same work, same knowledge and same topic. The point is to apply your newly acquired knowledge on several consecutive assignments.

Attendance is compulsory; you can miss up to two classes with an acceptable explanation except the lectures given by one of our distinguished guest speakers.

Plagiarism

Any non-acknowledgement or incorrect acknowledgement of sources is considered plagiarism and is strictly prohibited. Plagiarism is a serious academic offence; students whose research chapter does not hold to basic academic standards will automatically fail the course and their case will be passed to the disciplinary committee of the Faculty of Social Sciences. Please review <http://www.plagiarism.org/> to ensure that you are citing your sources correctly.

Deadlines

due lecture

Group policy paper	evening 8PM a day before	5 th
Group short presentations		8 th
Completed group project consisting of your individual chapters		12 th
Final presentation of your group's perspective on selected security issue		13 th

Course Schedule

The course consists of six general classes, three guest lectures and two seminars. Recognized speakers with extensive expertise in the field will be invited for each of these longer lectures. **These speakers will include senior officials and academics from Europe and the U.S., (i.e. International Telecommunication Union, U.S. government and U.S. private sector representatives)** These lectures will take place in the American Center in Prague.

The first part until the midterm test consists of extensive reading (6 weeks) during which each group will briefly introduce their planned policy architecture in group policy paper and 5-minute presentation on the date of the 5th lecture; the second part has no compulsory reading as it is devoted to each group's project development in three steps: the presentation of your draft by the 9th lecture, the chapter writing and preparation of the final study by the 12th lecture and its defense on the occasion of the 13th lecture.

This year's calendar exceptions:

- 30th September – Cancelled, to be substituted
- 7th October – Extended lecture (substituting cancelled Introduction on 30th Sep.)
- 14th October – Cancelled, to be substituted
- 21st October – Two lectures (3h, substituting cancelled lecture on 14th October)
- 28th October – Cancelled – national holiday
- 4th November – Guest Speaker (guest + classic lecture – 3h, substituting national holiday on 28th October)
- 6th January – Presentations of your projects in the examination period

Schedule:

1. 3rd October – Introduction
2. 10th October – The emergence of space domain and perspectives on space security
3. 17th October – Space technologies and their dual-use nature, from communication satellites and debris collectors to laser weapons
4. 24th October – Space-related hazards and threats – Orbital Debris
5. 31st October – Space-related hazards and threats – Asteroid or Comet Impact Event
6. 7th November – International organizations and law
7. 14th November – Territory and the geopolitics of outer space
8. 21st November – Space strategy: toward the space battlefield or operational sanctuary?
9. 28th November – Guest Speaker 1
10. 5th December – Guest Speaker 2
11. 12th December – Guest Speaker 3
12. 19th December – Final presentations of the group projects and closing remarks

New topics:

- space commercialization as a driver for outer space regime alteration
- technological game changers of future space policy

This year's topics for your group study

There are two scenarios, with one for each group; hence, two groups competing against each other to support their policy architecture (policy positions will be given out by the lecturer).

1) THE ORBITAL DEBRIS CHALLENGE

Earth's orbits are becoming saturated by various space systems. Each deployment creates some debris (e.g. small objects from rocket stage separations, etc.). Debris can also be created deliberately by, for example, the use of an ASAT weapon or due to an accident. The fact is that there are more than 21,000 orbital debris larger than 10 cm and approximately 500,000 particles between 1 and 10 cm in diameter. These particles are orbiting with sufficient velocity to destroy or seriously damage, or disable satellites and other systems/installations (e.g. the International Space Station).

Questions: How serious is this threat? Do we need to resolve it immediately or is there time to postpone it and concentrate on technology development for future remedies? How would you persuade other space-faring nations that the debris remediation technology is not a disguised space weapons program? What is the economic viability of an effective debris removal project? Does the debris threat require international cooperation or should a smaller group of space-faring leaders take responsibility for the space environment and safe operations (as creators of much of the current debris). Are existing initiatives being implemented widely (e.g. UNCOPUOS Space Debris Mitigation Guidelines?)

2) THE PLANETARY DEFENSE PROJECT

The second space security scenario requires more original technical analysis as well as challenging political negotiations, as it involves the willful action of one or more space-faring nations. Your task is to prove to relevant decision-makers, both domestically and internationally, that an asteroid will impact the Earth in some 24 months and that appropriate measures need to be taken at once to avoid or manage such a global catastrophe. Establishing cooperation with other space powers would raise your prospects for success.

Questions: What technologies and operational options are presently available to alter the orbit of an incoming asteroid, which space actors would conduct such

operations and is there enough time to deploy them effectively? What kind of “last resort” options are available? Who leads this international crisis response and how should such a “task force” communicate to the waiting world?

Questions in common:

- What types of international cooperation might be possible concerning such projects?
- What would be the principal venues or fora for such cooperative consultations?
- What political and technological obstacles have been identified?
- How you would manage complaints/concerns that might arise from the four general space security perspectives outlined in Chapter 1, of J.C. Moltz?
- What knock-on effects have you identified on the broader international political/security scene catalyzed by the proposed projects?

Course Requirements

The semester-long group project consists of four **different, but related and consecutive parts:**

- ***the policy paper*** offering your idea for a policy-related solution to the challenge, and restraints, that you would have already identified;
- ***the chapters*** written by individual students will be based on the results of the group research project, your questions to the guest lecturers, the quality of your findings and your individual contribution to the proposed policy;
- ***the final study*** will consist of the chapters written by each student
I will evaluate the entirety of the project and then each chapter separately.
- ***the group presentation*** of the final study

1. Policy paper

The policy paper is, in part, designed to demonstrate that you are keeping up with the global debate on space security issues in the pursuit of your project goals. The paper should crisply summarize your thoughts on the scenario assigned and logic flow leading to realistic and achievable policy recommendations. The overarching goal of this exercise is to have you recommend a comprehensive solution set for decision-makers and the kind of expertise they will need to mobilize to effectively manage these project scenarios.

There is a required format for these papers. They have to be policy-oriented, not merely a summary, and should focus on achievable policy solutions that are supported by verifiable facts, statistics, existing technologies, etc. As the scenarios are full of unknowns you should address the risks at each level of the operations, including underdeveloped science and other constraints.

Regard yourself as an expert in the field of space security. Support your ideas with strong argumentation and persuade those being addressed to follow your policy prescription. The policy recommendation must be formulated within the international security environment and conditions in the EU, the U.S. and perhaps other space-faring powers. The limit is 2000 words; eight standardized pages, which argue for a focus on lists of considerations. Address as much your topic as you can and try to ensure that your group is competitive in terms of structured argumentation with that of your opposing group.

The policy paper for each group has to be sent to the lecturer by 8PM the preceding day. There are number of Internet sites addressing effective policy paper writing skills. I suggest you check them before you begin or make use of the Purdue Writing Lab – <http://owl.english.purdue.edu>

2. Chapter

This chapter will serve as a centerpiece of your course work and allow you to demonstrate your basic understanding of space security of your previous choice and the nature of the challenges that lie ahead.

The chapter should be well-written and consistent with academic standards. Formal requirements, such as citation standards, footnotes etc. are important. The paper should be

disciplined and seek to identify the ingredients that may influence the development of a national policy. The chapter should be around 5-10 pages (1250-2500 words).

3. The Final Study

Each group will merge their chapters into final study. The evaluation will pay attention on:

- Detail of the problem analysis
- Consistency, cohesion and cross-linking among chapters
- Feasibility based on your argumentation
- Convincing explanation concerning how to deal with other space security constituencies and their possible opposition to your proposed policy architecture
- Compelling arguments for your chosen technologies and how to avoid engendering distrust among other space-faring nations

The study should have the components of a standard academic paper: abstract, introduction, body, conclusion, list of references. I would also appreciate figures, graphs, images, list of abbreviations, footnotes etc. Use reference style Chicago 16th Note with the list at the end of your study. I recommend you to use a citation manager such as Mendeley or Zotero.

4. Final presentations

During the final lecture, the groups will be defending their positions and explaining the reasons for their final policy choices.

Group presentations involve teamwork in developing the critical analysis of the proposed topic. Students are encouraged to analyze the topic from the following points of view, although it is not mandatory to follow this structure of dividing your project into individual chapters which will each have a different emphasis and but be reinforcing and self-sustaining. Remember that it is a group proposal. Coverage should include:

- 1) historical background of the space security issue selected
- 2) available technologies and their reported characteristics
- 3) feasibility study of proposed technological solutions
- 4) argumentation on a geopolitical level emphasizing peaceful intentions
- 5) the implications of a particular solution for the global security environment
- 6) reflections on national policies that can prevent the emergence of the identified threat or risk
- 7) possible future impact of likely developments

The point of this exercise is to learn how to present cogent arguments based on the collective efforts of a small research team, not how to summarize general knowledge. A Power Point or digital presentation is not required, but may help you keep the attention of your audience. You should have about 80% of your arguments ready and be prepared to engage in active exchanges with the GUEST SPEAKERS about your proposed solutions.

Course literature and Lecture Structure

The category of compulsory reading is just that – compulsory. Each lecture is covered by 50-100 pages of reading. You may be asked about particular topics during the respective lectures. Your active classroom participation, informed questions and debating skills should all serve to enrich the proceedings. Recommended reading is designed to orient and expose you to a broad array of space security topics; especially for those who are preparing a related chapter. An asterisk indicates the importance to the topic of a particular lecture. You should be adequately prepared for the guest lectures in the second half of the semester, during which you can demonstrate your grasp of the material and help develop your project.

3RD OCTOBER – INTRODUCTION

Read thoroughly the syllabus and prepare your questions concerning the course requirements and group project. We can also discuss some details of the assigned literature. Some recommendations at the beginning follows.

Compulsory reading on introduction class:

- <https://www.washingtonpost.com/news/checkpoint/wp/2016/01/27/space-warfare-with-russia-and-china-pentagon-urged-to-prepare-for-it/>

Books available in Jinonice library:

- *** Johnson-Freese, J. (2013). *Space as a Strategic Asset*. Columbia University Press.
- *** Moltz, J. C. (2011). *The Politics of Space Security* (p. 383). Stanford, California: Stanford University Press.
- *** Bormann, N., & Sheehan, M. (2009). *Securing Outer Space*. New York: Routledge.
- ** Coletta, D., & Pilch, F. T. (2013). *Space and Defense Policy*. Taylor & Francis.
- ** Arbatov, A., & Dvorkin, V. (2010). *Outer Space: Weapons, Diplomacy and Security* (p. 115). Washington D.C.: Carnegie Endowment for International Peace.
- * Klein, J. J. (2006). *Space Warfare: Strategy, Principles and Policy* (p. 196). London and New York: Routledge.

Books available in PSSI library:

- ******* (2015). *Handbook of Space Security*. (K.-U. Schrogl, P. L. Hays, J. Robinson, D. Moura, & C. Giannopapa, Eds.). New York: Springer.**

Other books (some available at National library in Klementinum):

- Abeyratne, R. (2011). *Space security law* (p. 180). London: Springer.
- Al-Rodhan, N. R. F. (2012). *Meta-Geopolitics of Outer Space : An Analysis of Space Power, Security and Governance*. Palgrave Macmillan.
- Brown, K. K. (n.d.). *Space Power Integration. Perspectives from Space Weapons Officers*.
- Br  nner, C., & Soucek, A. (2011). *Outer Space in Society, Politics and Law*. Wien: SpringerWienNewYork.
- Denis, J. H., & Aldridge, P. D. (2009). *Space Exploration Research* (p. 579). New York: Nova Science Publishers, Inc.
- Erickson, M. (2005). *Into the Unknown Together. The DOD, NASA, and Early Spaceflight*. Maxwell: Air University Press.
- Hays, P. (2011). *Space and Security: A Reference Handbook*. Santa Barbara, California: ABC-CLIO.
- Kay, W. D. (n.d.). *Defining NASA : the historical debate over the agency's mission*. New York: State University of New York Press.
- Klinkrad, H. (2006). *Space Debris*. Springer.
- Lee, R. (2012). *Law and Regulation of Commercial Mining of Minerals in Outer Space*. Sydney: Springer.
- Macdonald, M., & Badescu, V. (n.d.). *The International Handbook of Space Technology*. Heidelberg: Springer.
- Mutschler, M. (2013). *Arms Control in Space. Air University Review*. New York: Palgrave Macmillan.
- O'Hanlon, M. E. . (2004). *Neither Star Wars nor Sanctuary* (p. 191). Washington D.C.: Brookings Institution Press.
- Pelton, J. N. (2013). *Space Debris and Other Threats from Outer Space*. New York: Springer.
- Peoples, C. (2010). *Justifying ballistic missile defence: technology, security and culture*. Cambridge University Press.

- Reiss, E. (1992). *The strategic defense initiative*. Cambridge University Press.
- Weeks, E. E. (2012). *Outer Space Development, International Relations and Space Law* (p. 287). Cambridge Scholars Publishing.
- Wirbel, L. (2004). *Star Wars : US Tools of Space Supremacy*. London: Pluto Press.
- Wolfgang Rathgeber, Kai-Uwe Schrogl, & Ray A., W. (2010). *The Fair and Responsible Use of Space: An International Perspective*. New York: Springer New York.
- Wolter, D. (2005). *Common Security in Outer Space and International Law*. Geneva: United Nations.

Recommended journals available from UK network:

- Space Policy – <http://www.sciencedirect.com/science/journal/02659646>
- Astropolitics – <http://www.tandfonline.com/toc/fast20/current>

Websites:

- European Space Policy Institute – www.espi.or.at
- Space Policy Institute – <http://www.gwu.edu/~spi/>
- NASA – www.nasa.gov
- ESA – www.esa.eu
- UN Office for Outer Space Affairs (UNOOSA) - <http://www.unoosa.org/oosa/index.html>
- SPACE.COM – www.space.com

List of movies related to space program:

- The Right Stuff (1983) – <http://www.imdb.com/title/tt0086197>
- Apollo 13 (1995) – <http://www.imdb.com/title/tt0112384/>
- Europa Report (2013) – <http://www.imdb.com/title/tt2051879/>
- Interstellar (2014) – <http://www.imdb.com/title/tt0816692/>
- Gravity (2013) – <http://www.imdb.com/title/tt1454468/>
- Destination Moon (1950) – <http://www.imdb.com/title/tt0042393/>

Series:

- Cosmos: The Space Time Odyssey (2013) – <http://www.imdb.com/title/tt2395695/>
- Stephen Hawking's Universe (2010) – <http://www.imdb.com/title/tt1655078/>

10TH OCTOBER – THE EMERGENCE OF SPACE DOMAIN AND PERSPECTIVES ON SPACE SECURITY

Lecture content:

- The basics of outer space physics and orbital mechanics.
- How viable are the analogies between outer space and previous newly colonized areas.
- A brief history of major space programs and the link between civilian and security sectors. When the superpowers cooperated and when they competed?
- Individual national ambitions versus global cooperation.
- What are the most prominent space assets and what is the level of dependency on them?
- Four schools of thought on space security by Moltz.

Compulsory reading (53p):

- (7p) *America's Future in Space*. (2009). Harv. JL & Tech. (p. 106). Washington D.C.: National Academies Press. (Chapter 1)
- (31p) Moltz, J. C. (2008). Part I. Explaining Space Security: Concepts and Historical Comparisons. In *The Politics of Space Security* (pp. 11–41). Stanford, California: Stanford Security Studies.
- (15p)¹ USAF, Air University Space Primer, Chapter 8 – Orbital Mechanics (start with section Orbital Motion, page 8-8)

Recommended skim reading (60p):

- (27p) Robertson, A. (2011). Introduction In *Militarization of Space* (pp. 3 - 29).
- (24p) Moltz, J. C. (2008). Part I. Explaining Space Security: Concepts and Historical Comparisons. In *The Politics of Space Security* (pp. 42–65). Stanford, California: Stanford Security Studies.
- (9p) USAF, Air University Space Primer, Chapter 8 – Orbital Mechanics (the rest)

Websites to check:

- <http://csewi.org/number-of-military-communication-satellites-by-country/>

Recommended movie:

- The Right Stuff (1983) – <http://www.imdb.com/title/tt0086197>

Recommended computer game:

- Kerbal Space Program – good way to understand orbital mechanics and basics of launch technology in several space programs

Additional reading:

- *** Mueller, K. (2003). Totem and Taboo: Depolarizing the Space Weaponization Debate. *Astropolitics*, 1(1), 4–28.
- *** Hays, PL. Background and history In *Space and Security: A Reference Handbook*. (pp. 16-62). Santa Barbara, California: ABC-CLIO. 2011.
- * Reiss, E. (1992). *The strategic defense initiative*. Cambridge: Cambridge University Press.
- * Wirbel, L. (2004). *Star Wars : US Tools of Space Supremacy*. (pp. 30-83). London: Pluto Press.

¹ Skim read to get involved into the orbital mechanics laws, you don't need to read it thoroughly, but you should know what are newton laws, what does it mean to break in space, speeds on orbit etc.

17TH OCTOBER – SPACE TECHNOLOGIES AND THEIR DUAL-USE NATURE, FROM COMMUNICATION SATELLITES AND DEBRIS COLLECTORS TO LASER WEAPONS

Lecture content:

- The dilemma of dual-use technology; history and present day
- The difference between militarization and weaponization of space
- Space weapons versus space enabled weapons
- Space warfare versus space enabled warfare
- Why states seek space weapons and what key questions arise?
- From defensive measures to space control
- Current and planned space security operations by US, Russia and China

Compulsory reading (54p):

- (25p) Freese, J.J. (2007). Chapter 2. – The Conundrum of Dual-Use Technology In Space as a Strategic Asset. (pp. 27-51). New York: Columbia University Press.
- (18p) Webb, D. (2009). Space weapons: dream, nightmare or reality? In N. Bormann (Ed.), *Securing Outer Space* (pp. 24–41). New York: Routledge.
- http://praxis.leedsmet.ac.uk/praxis/documents/space_weapons.pdf
- (6p) Hilborne, M. (2013). China's rise in space and US policy responses: A collision course? *Space Policy*, 29(2), 121–127.
- (5p) (Chapter 1. compulsory, the rest skim read) USAF. (2004). *Counterspace Operations* (p. 67). Washington D.C.

Websites:

- <http://actu.epfl.ch/news/cleaning-up-earth-s-orbit-a-swiss-satellite-tack-2/>
- President Reagan's speech on SDI – <https://www.youtube.com/watch?v=ApTnYwh5KvE>

Recommended skim reading (10p):

- (10p) Kelso, T. S. (2007). Analysis of the 2007 Chinese ASAT Test and the Impact of its Debris on the Space Environment. In *2007 AMOS Conference* (pp. 321–330). Maui, Hawaii: Center for Space Standards & Innovation.

Additional reading:

- *** Freese, J.J. (2007). Chapter 4. – The militarization of space and Chapter 5. – The weaponization of Space In Space as a Strategic Asset. (pp. 82-140). New York: Columbia University Press.
- *** Preston, B., Johnson, D. J., Edwards, S. J. A., Miler, M., & Shipbaugh, C. (2002). *Space Weapons Earth Wars*. Santa Monica, CA: RAND Corporation.
- ** Dvorkin, V. (2011). Space Weapons Programs. In A. Arbatov & V. Dvorkin (Eds.), *Outer Space: Weapons, Diplomacy, and Security* (pp. 30–45). Carnegie Endowment.
- ** O'Hanlon, M. E. (2004). *Neither Star Wars nor Sanctuary* (p. 191). Washington D.C.: Brookings Institution Press.
- ** Arbatov, Alexei, and Vladimir Dvorkin. 2010. *Outer Space: Weapons, Diplomacy and Security*. Washington D.C.: Carnegie Endowment for International Peace.
- *** Klein, John J. 2006. *Space Warfare: Strategy, Principles and Policy*. London and New York: Routledge.
- ** Hebert, Karl D. 2014. "Regulation of Space Weapons: Ensuring Stability and Continued Use of Outer Space." *Astropolitics* 12 (1) (January 2): 1–26.

24TH OCTOBER – SPACE-RELATED HAZARDS AND THREATS – ORBITAL DEBRIS

Lecture content:

- The summary of known outer space threats from human operations
- Space debris mitigation problem and why the current solutions raise questions
- Collisions of spacecraft and how to avoid them.

Compulsory reading (40p):

- (3p) Slann, P. A. (2014). Space debris and the need for space traffic control. *Space Policy*, 30(1), 40–42.
- http://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf

Recommended skim reading:

- (18p) McCormic, P. (2015). Space Situational Awareness in Europe: The Fractures and the Federative Aspects of European Space Efforts. *Astropolitics*, 13(1), 43–64.
- (58p) Pelton, J. N. (2013). *Space Debris and Other Threats from Outer Space*. (pp. 1–44, 57–80). New York, NY: Springer New York.
- *** Martinez, P., Crowther, R., Marchisio, S., & Brachet, G. (2014). Criteria for developing and testing Transparency and Confidence-Building Measures (TCBMs) for outer space activities. *Space Policy*, 30(2), 91–97.
- ** The Issue of Space Debris In Hays, P. L. (2015). *Handbook of Space Security*. (pp. 680–697). New York: Springer.
- * Klinkrad, H. (2006). *Space Debris*. Springer.

Websites:

- <http://www.space.com/23039-space-junk-explained-orbital-debris-infographic.html>
- <http://www.space.com/24895-space-junk-wild-clean-up-concepts.html>

31ST OCTOBER – SPACE-RELATED HAZARDS AND THREATS – ASTEROID OR COMET IMPACT EVENT

Lecture content:

- Planetary Defense endeavor – when asteroids or comets are on their way
- The ideas on global governance of planetary defense

Compulsory reading (40p):

- (3p) Weeden, B. (2010). 2009 Iridium - Cosmos Collision Fact Sheet. Secure World Foundation.
- (7p) Schweickart, R. L. (2009). Decision program on asteroid threat mitigation. *Acta Astronautica*, 65(9-10), 1402–1408.
- (26p) NASA. (2007). Near-Earth Object Survey and Deflection Analysis of Alternatives. *A Report to congress*.
- (11p) Remuss, Nina-Louisa. (2011). 4.2.3 Asteroids/Near Earth Objects (NEO). In Brünner, C., & Soucek, A. *Outer Space in Society, Politics and Law* (pp. 547–558). Wien: SpringerWienNewYork.

Recommended skim reading:

- Pelton, J. N., Allahdadi, F. (2015). *Handbook of Cosmic Hazards and Planetary Defense*. Springer International Publishing.
- Thangavelu, Madhu et al. 2015. *READI - Roadmap of Earth Defense Initiatives*. Athens (OH). Retrieved:
https://isulibrary.isunet.edu/opac/doc_num.php?explnum_id=722

Websites:

- <http://sentinelmission.org/>
- <http://www.space.com/27958-russian-asteroid-impact-fears-2014-ur116.html>
- <http://neo.jpl.nasa.gov/index.html>
- <http://www.oosa.unvienna.org/oosa/en/new.html>
- Video - cosmic hazards, Pelton:
<https://www.youtube.com/watch?v=IJDGD73aD9s>
- Near Earth Object NASA - <http://neo.jpl.nasa.gov/ca/>
- NEO Deflection APP - <http://neo.jpl.nasa.gov/nda>
- <http://neo.jpl.nasa.gov/pdc15>
- NASA NEO CAM - <http://neocam.ipac.caltech.edu/>
- Statistics of impacts:
<http://www.nature.com/nature/journal/v420/n6913/full/nature01238.html>
- Laser Bees project - <http://www.planetary.org/explore/projects/laser-bees/>
- Scott Manley – NEOs discovery -
<https://www.youtube.com/watch?v=xJsUDcSc6hE>
- <http://www.lpi.usra.edu/exploration/> (from Earth to the Moon)

13. 14th November – Territory and the geopolitics of outer space

21ST NOVEMBER –

Lecture content:

- The current legal framework for space activities
- The question of space resource exploitation
- Tackling control of dual-use space technology
- Dilemmas facing civilian exploration projects

Compulsory reading (46p):

- <http://www.lifeofthelaw.org/2015/11/space-law-2-0/>
- (30p) Kasku-Jackson, J., & Waldrop, E. (2009). Understanding space law: legal framework for space. In D. Coletta & F. T. Pilch (Eds.), *Space and defense policy* (pp. 64–103). New York: Routledge.
- (16p) Chatterjee, P. (2014). Legality of Anti-Satellites Under the Space Law Regime. *Astropolitics*, 12(1), 27–45.

Recommended reading:

- *** United Nations Treaties and Principles On Outer Space, related General Assembly resolutions and other documents, ST/SPACE/61/Rev.1. Retrieved from:
http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf
- *** Graham, T., & Huskinson, D. (2009). Cooperation in space: international institutions. In D. Coletta & F. T. Pilch (Eds.), *Space and Defense Policy* (pp. 104–124). New York: Routledge.
- ** Remuss, Nina-Louisa. (2011). 4.2 Space and security. In Brünner, C., & Soucek, A. *Outer Space in Society, Politics and Law* (pp. 519–547). Wien: SpringerWienNewYork.
- *** Hebert, K. D. (2014). Regulation of Space Weapons: Ensuring Stability and Continued Use of Outer Space. *Astropolitics*, 12(1), 1–26.
- ** (31p) Lee, R. (2012). 3.2. Sources of Space Law. In *Law and Regulation of Commercial Mining of Minerals in Outer Space* (pp. 98–128). Sydney: Springer.
- ** Weeks, Edythe E. 2012. *Outer Space Development, International Relations and Space Law*. Cambridge Scholars Publishing.

14TH NOVEMBER – TERRITORY AND THE GEOPOLITICS OF OUTER SPACE

Lecture content:

- Introduction to the geopolitics of space and related notions of power
- The relation between a state's terrestrial power and the domination of space
- Space exploration as a strategy of international security
- How the domination of space by one party could make current modes of security less irrelevant

Compulsory reading (86p):

- (26p) Havercroft, J., & Duvall, R. (2009). Critical astropolitics: the geopolitics of space control and the transformation of state sovereignty. In N. Bormann (Ed.), *Securing Outer Space* (pp. 59–75). New York: Routledge.
- (15p) Stuart, J. (2009). Unbundling sovereignty, territory and the state in outer space: two approaches. In N. Bormann (Ed.), *Securing Outer Space* (pp. 8–23). New York: Routledge.
- (45p) Moltz, J. C. (2008). Renewed U.S. Space Nationalism: 2001-2008. In *The Politics of Space Security* (pp. 259–304). Stanford, California: Stanford Security Studies.

Recommended skim reading:

- *** Dalby, S. (2008). Imperialism, Domination, Culture: The Continued Relevance of Critical Geopolitics. *Geopolitics*, 13(3), 413–436.** Duvall, R., & Havercroft, J. (2008). Taking sovereignty out of this world: space weapons and empire of the future. *Review of International Studies*, (October). Retrieved from http://journals.cambridge.org/abstract_S0260210508008267
- *** Al-Rodhan, N. R. F. (2012). *Meta-Geopolitics of Outer Space : An Analysis of Space Power, Security and Governance*. Palgrave Macmillan.
- Edwards, M. (2009). "God has chosen Us": Re-Membering Christian Realism, rescuing christendom, and the contest of responsibilities during the cold war. *Diplomatic History*, 33(1), 67–94.
- Duvall, R., & Havercroft, J. (2008). Taking sovereignty out of this world: space weapons and empire of the future. *Review of International Studies*, 34(October), 755–775.

21ST NOVEMBER – SPACE STRATEGY: TOWARD THE SPACE BATTLEFIELD OR OPERATIONAL SANCTUARY?

Lecture content:

- How the space environment influences the notions of grand strategy.
- Secure space by dominance or through wider cooperation?
- Space dreams, scientific explorations and strategy.
- From bipolar competition to the world of multipolar space-faring nations.
- GPS, Galileo, ISS and SSA and the vision of collaborating nations in space.

Compulsory reading (61p):

- (14p) Wirtz, J.J. Space and Grand Strategy *In* Coletta, D., & Pilch, F. T. (2013). *Space and Defense Policy*. (pp. 13-26). Taylor & Francis.
- (26p) Freese, J.J. (2007). Chapter 1. – A Clash of Ambitions In Space as a Strategic Asset. (pp. 1-27). New York: Columbia University Press.
- (21p) Neger, T., & Soucek, A. (2011). 2.5 Cooperation in space. In Brünner, C., & Soucek, A. *Outer Space in Society, Politics and Law*. (pp. 178–197). Wien: SpringerWienNewYork.

Recommended skim reading (50p):

- (22p) Neger, T., & Soucek, A. (2011). 2.4 Space faring: a short overview of the present situation. In Brünner, C., & Soucek, A. *Outer Space in Society, Politics and Law*. (pp. 157–197). Wien: SpringerWienNewYork.
- (28p) Moltz, J. C. (2008). Chapter 9. Alternative Futures for Space Security In *The Politics of Space Security* (pp. 326-353). Stanford, California: Stanford Security Studies.

National space policies (additional):

- *** Honkova, J. (2013). *The Russian Federation's Approach to Military Space and Its Military Space Capabilities*. Arlington, Virginia, USA: George Marshall Institute.
- ** UK National Space Security Policy. (2014). HM Government.
- ** National Security Space Strategy, unclassified summary. (2011). Washington D.C.
- ** Towards A Space Strategy For The European Union That Benefits Its Citizens. (2011). Brussels: European Commission.
- ** Barroso, J. M. D. (2009). *The Ambitions of Europe in Space*. In *Conference on European Space Policy*. Brussels: European Commission.

Additional reading:

- *** Moltz, J. C. (2008). Chapter 8. Expanding International Norms amid Tensions: 2009 – Present In *The Politics of Space Security* (pp. 305-325). Stanford, California: Stanford Security Studies.
- ***** Freese, J.J. (2007). Chapter 9. – Avoiding a Clash of Ambitions In Space as a Strategic Asset. (pp. 233-258). New York: Columbia University Press.
- *** Robinson, R. W., & Davenport, A. K. (2012). *Advancing Space Security through trilateral U.S. - Europe-Japan Partnership*. Prague, Washington D.C.: PSSI.
- ** Kay, W. D. (n.d.). *Defining NASA : the historical debate over the agency's mission*. New York: State University of New York Press.
- * Zervos, V. (2004). The impact of the us strategic defence initiative on the space race. *Defence and Peace Economics*, 15(4), 365–377.