

## Course Information

### Course Information

The History of Space Exploration, Science, and Technology SPACE 9004

### Prerequisites

SPACE 9001

SPACE 9002

SPACE 9003

## Instructor Information

Dr. Daniel Bednar

Adjunct Professor, Western University

## Course Syllabus, Schedule, Delivery Mode

This course introduces students to the importance of space as a place of endeavor for all humans. It examines the progression from the earliest thinking about the cosmos, to the modern reality of space-based technology in student's daily lives. Space will be explored largely from a historical and geographical lens, with the goal of understanding major space events as they relate to various fields of science, as well as their political and social contexts. (.50 credit)

The course is divided into three distinct four-week sections, History, Earth Applications and Planetary Exploration. Starting from the late 19th century, through to 2018, the course provides an overview of the progression of human-space interaction, key developments, and historical context of space exploration and the wider space sector. From the development of the rocket equation in 1903 to the ubiquitous use of global navigation satellite systems and Earth observation in our daily lives today, students gain an understanding of the progress of human engagement with space.

### Course Outcomes

At the conclusion of the course, students will be able to:

- 1) Formulate a timeline of key events in the history of space science and exploration and appraise their relationship to modern issues in relevant fields.
- 2) Formulate a timeline of key events in the history of space technology and Earth applications as well as be able to assess their relationship broader societal processes.
- 3) Appraise and critique multiple perspectives regarding formative controversies in the history of space exploration, science, and technology.

- 4) Outline and justify ethical practices for human interaction with non-Earth places with reference to past experiences in space exploration, science, and technology.
- 5) Implement effective, transparent, and rigorous research into past space exploration activities with the purpose of informing novel insights on topics in space exploration.

Week	Topic	Instructor Video	Interactive PDF Lesson	Materials	OWL Reflection Question	OWL Q&A Forum	Assignment
1	History: The Space Race	Course Intro/Prelude to Sputnik	The Space Race	<b>Sagdeev (2007)</b> Sputnik and the Soviets <b>Neufeld (2002)</b> von Braun, the SS and Concentration Camp Labour <b>McDonald (2008)</b> Space and the Atom: On Popular Geopolitics of Cold War Rocketry	What is von Brauns Legacy?	Post a Question	Q&A Post Reflection
2	History: The Apollo Program	Zond: The Forgotten Soviet Lunar Program	Apollo Program	<b>Launius (2003)</b> Public Opinion Polls and Perceptions of US Human Spaceflight <b>Orloff &amp; Harland (2006)</b> Apollo 11 - Landing on Mare Tranquilitas <b>NASA (2014)</b> CBS Coverage of Apollo 11 Lunar Landing	What is the legacy of Apollo Resistance?	Post a Question	Q&A Post Reflection
3	History: The Soyuz	Soyuz Tragedies	Soyuz: O! Reliable	<b>ESA (2013)</b> Journey to the ISS: Parts 1-3 <b>Lardier &amp; Barensky (2013)</b> The Soyuz Launch Vehicle: Chapter 5: The Various Versions	What was the "Space Race"?	Post a Question	Q&A Post Reflection
4	History: Space Stations and the U.S. Space Shuttle	Shuttle Tragedies	Space Stations and the Space Shuttle Timeline	<b>U.S. Presidential Commission (1986)</b> Chapters I, II, & VI <b>Columbia Accident Investigation Board (2003)</b> Chapters 7 & 8 <b>Baker (2007)</b> Chapter 3 & 8 <b>NASA (2012)</b> Space Station Tour <b>PBS (2013)</b> Women in Space	Could the Challenger Disaster have been avoided? How?	Post a Question	Q&A Post Reflection <b>Quiz 1</b>
5	Earth Applications: Earth Observation	The First Picture of Earth	A History of Space-Based Earth Observation	<b>Tan (2014)</b> Meteorological Satellite Systems: Chapters 2 & 7	Is global climate change the defining challenge of space applications?	Post a Question	Q&A Post Reflection
6	Earth Applications: Navigation	The Story of GPS	A History of Global Navigation Satellite Systems	<b>Madry (2015)</b> Global Navigation Satellite Systems and Their Applications: Chapters 1 & 3	Are navigation systems an essential public service?	Post a Question	Q&A Post Reflection
7	Earth Applications: Communication	The Story of the ITU	A History of Telecommunications Satellites	<b>Allison (2014)</b> The ITU and Managing Satellite Orbital and Spectrum Resources: Chapter 2 <b>Pelton (2012)</b> Satellite Communications: Chapters 1, 2, & 3	Is the ITU equitable?	Post a Question	Q&A Post Reflection
8	Earth Applications: Business	What is "NewSpace"?	History of Business Ventures in Space	<b>Gurtana (2013)</b> Fundamentals of Space Business and Economics: Chapters 1, 2, and 6 <b>Schwartz (2014)</b> Prioritizing Scientific Exploration - A Comparison of the Ethical Justifications for Space Development and for Space Science <b>Dunnet et al. (2017)</b> Geographies of Outer Space: Progress and New Opportunities	What is "NewSpace"?	Post a Question	Q&A Post Reflection <b>Quiz 2</b>
9	Planetary Exploration: Space in Popular Culture	Arthur C. Clarke's Earthly Visions of Space	Allegories and True Stories: The History of Space Exploration in Western Film	<b>Bernardi (1997)</b> Star Trek in the 1960s <b>Seed (2010)</b> The Course of Empire	How do film portrayals of space exploration in Western culture relate to actual ideas of space exploration in practice?	Post a Question	Q&A Post Reflection
10	Planetary Exploration: Robotic Exploration of The Moon and Mars	Canals on Mars	A History of Lunar and Martian Robots	<b>Van Pelt (2007)</b> Chapter 2 - A Space Robot is Born <b>Harvey &amp; Zakutnyaya (2011)</b> Chapter 5: Path to Mars <b>Conley &amp; Rummel (2013)</b> Appropriate Protection of Mars	What has been more effective: human exploration or robotic?	Post a Question	Q&A Post Reflection
11	Planetary Exploration: Venus, Small Bodies, and Dwarf Planets	When Hayabusa met Itokawa	A Brief History of Landers and Orbiters Around the Solar System	<b>Harvey (2008)</b> The High Summer of Soviet Planetary Exploration <b>sci.esa.int (2017)</b> Venus Express: Mission Overview & Major Discoveries 1-8 <b>NASA (2015)</b> Unveiling Ceres <b>ESA (2016)</b> Rosetta Grand Finale Press Kit Lauretta	Has Venus been ignored, why? Or why not?	Post a Question	Q&A Post Reflection
12	Planetary Exploration: The Gas Giants	That Time we went to Neptune and Uranus	From Voyager to Juno	<b>Meltzer (2015)</b> Chapter 1: Conceiving and Funding Cassini <b>Star Talk Radio (2017)</b> Enceladus Up Close <b>Impey &amp; Henry (2013)</b> Chapter 4: Voyager: Grand Tour of the Solar System	What is the significance of the controversy over Cassini's launch?	Post a Question	Q&A Post Reflection <b>Quiz 3</b>

Provide lecture/lab/tutorial schedule (weekly meeting time) and information about the delivery mode (in-person, synchronous online, asynchronous online).

## 4. Course Materials

There is no textbook for the course. With the exception of select videos hosted on YouTube or government websites, all readings will be posted on OWL and are accessible digitally through your Western Libraries online account.

Students should check OWL (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis.

All course material will be posted to OWL: <http://owl.uwo.ca>.

If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

### Technical Requirements

- Access to a stable internet connection
- A computer with a working webcam and microphone
- An installed copy of Zoom

## 5. Methods of Evaluation

### Q&A Posts

Each week, you will be asked to post a single question about the material covered. Answers to these questions will be responded to via video by the instructor and posted on OWL. Both the questions and the video responses will be visible to all students. So long as the question is of relevance to the material, students are expected to receive that week's Q&A mark.

### Reflection Pieces

Each week students are asked to post a short 500-1000 word response to the reflection question of the week. Two marks are available each week. The first mark will be awarded for effective exploration and interpretation of the question itself. The second mark will be provided for the response to the question if it is a) a clear position, and b) references a credible source. These reflections will be visible only by the instructor.

### Quizzes

Every four weeks there will be a timed quiz conducted via OWL. The quiz will cover material from the entire section (which includes the week it is posted). Students will have a 48 hour period to decide when to do the quiz, and 1 hour to complete the quiz once it is started. Subject to change, the quizzes will consist of:

- Ten Multiple Choice Questions
- Ten Fill in the Blank
- Four Short Answer Questions (250-500 words each).

### Final Project

The final project is designed to combine the course's historical focus with skills for effective report writing. The assignment requires an 8-12 page report on the history of space assets in a particular country. This report should

include both a list of assets as well as brief descriptions. The United States and Russia are not options for this assignment. The assignment must also include at least ten space assets, meaning that if you would like to cover emerging space nations, with few historical or current assets, you may combine several countries from the same continent into a single report in order to reach the ten asset minimum.

A space asset is defined as a piece of hardware (full satellite or instrument) put into space to orbit, flyby, or land on a planetary body (including the Earth, with the exception of landers...). Identified assets will be those that were/are built and operated by the country you chose. The asset does not have to have been launched by the country.

Regardless of whether you choose a country with a large number of historical and present assets, or several countries with few, the structure of the report will be relatively similar for all. The report will be marked out of 100 and should include

- 1) A list identifying all launched assets built or owned by the country, or as many as you can confidently identify (ideally all) (20).
- 2) A launch year, activity status, and brief description of each asset (20)
- 3) A discussion of five key historical moments in the nation's space activity (10)
- 4) Five in-depth discussions (side boxes) of important current assets (10)
- 5) A section discussing the benefits derived from the country's space assets (10)
- 6) Clear evidence of effective, diverse, and high-quality research (20)
- 7) Clear evidence of proof reading, formatting effort, and effective writing (10)

The document is to be written as a report aimed at both the public and elected officials. Therefore, writing should effectively balance between necessary technical detail and accessibility to interdisciplinary audiences.

The report should be written in 12 pt. font and single spaced. All images must be properly referenced to the correct owners. Information regarding historical and current assets must come from reliable and official sources, such as: government websites, academic research, and respected professional popular writing or news agencies (major news outlets and professional publications only). References should be clearly referenced in APA style on a final page (reference pages do not count towards limit). The more diverse your sources are, the more comprehensive the report will be considered.

The overall course grade will be calculated as listed below:

Q &A Posts	12_ %
Reflection Questions	24_ %
Quizzes	30_ %
Final Project	34_ %

### **Accommodated Evaluations**

Late assignments will not be accepted.

Extensions may be granted for medical, personal, or other unforeseen circumstances in-line with Western University's policies on academic accommodations.

## **6. Accommodation and Accessibility**

### **Accommodation Policies**

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf)

### **Academic Consideration for Student Absence**

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Consideration\\_for\\_absences.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf)  
and for the Student Medical Certificate (SMC), see:  
[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

### **Religious Accommodation**

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see [http://www.registrar.uwo.ca/examinations/exam\\_schedule.html](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

## 7. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

### **Contingency plan for an in-person class pivoting to 100% online learning**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

**All of the remote learning sessions for this course will be recorded.** The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## 8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western ([http://www.health.uwo.ca/mental\\_health](http://www.health.uwo.ca/mental_health)) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.