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Dakota Space Society
Northern Skies Astronomical Society
American Institute of Aeronautics and Astronautics Student Chapter

RESEARCH FACILITIES

Infrastructure
High Altitude Ballooning Laboratory
Space Studies Observatory
Space Life Sciences Laboratory (temporarily out of service)
Spacecraft Simulator Facility
Human Spaceflight Laboratory
North Dakota Planetary Exploration Initiative
Space Studies Reference Collection

NORTH DAKOTA SPACE GRANT CONSORTIUM AND ND NASA EPSCoR

CAREER CONSIDERATIONS
GUIDE TO THE HANDBOOK
The Department of Space Studies recommends that you read this Graduate Student Handbook before starting each semester to determine whether or not there are any critical requirements that you must meet before you can graduate. There have been instances in the past where students have ignored certain requirements and procedures only to be disappointed when they were not able to graduate in the semester they planned. This handbook is updated periodically and the policies and procedures in place in the current edition will apply. If you are unable to find an answer within these pages, please ask your advisor or the Director of Graduate Studies, Dr. Michael Dodge. Good luck in pursuing your degree in Space Studies.

WELCOME TO THE DEPARTMENT OF SPACE STUDIES
The faculty and staff in the Department of Space Studies at the University of North Dakota (UND) are pleased to welcome you to the Masters of Science in Space Studies. Please consider the Department as your home where you can learn about the field of Space Studies. The goal of the faculty and staff is to guide, inform, stimulate, and present you with a variety of educational experiences to prepare you for placement in a space-related field. The Department offers formal courses, seminars, discussions, and field trips to enrich your graduate education. Additionally, through the Internet, telephone conferences, and personal appearances, such as with the Space Studies Colloquium, you will meet and interact with experts in the space field to stimulate your thinking about current and future space activities. As a graduate of the Masters of Science in Space Studies, you will be a leader in this interdisciplinary endeavor of space exploration and the development of space.

The Department of Space Studies was the first interdisciplinary space program in the world. Most colleges and universities offer degrees in space sciences and engineering, whereas the UND Space Studies Master of Science degree combines space physical science, space life science, space engineering, space policy and law, management of space organizations, and space history. The next generation of space program decision-makers will need the expertise provided by this program to oversee future space achievements. While engineers and scientists provide the technical craft to accomplish space goals, knowledgeable managers and analysts with broader backgrounds that understand the linkages between technology, science, policy, law, and management will decide what those goals should be and how to implement them. The National Aeronautics and Space Administration (NASA), the commercial space industry, the military, and the educational segments of the U.S. and international space programs need our Space Studies graduates who will be well prepared to participate, lead, and guide space exploration and development of space activities.

HISTORY OF THE DEPARTMENT
In 1986, Dr. David Webb, a member of the 1985-1986 Presidential Commission on Space, was hired as the first chair of the Department of Space Studies. In 1987 he founded the department as an integral part of the UND School of Aerospace Sciences. Prior to this, in the early 1980s, John D. Odegard, the Dean of the school, invited Buzz Aldrin, the second man to walk on the Moon, to come to UND to help organize a space education program. Aldrin’s contributions included recommending the appointment of Dr. Webb to design the space studies program and to serve as the first chair of the Department. The original faculty included Dr. Richard Parker, life sciences; James Vedda, military and commercial space; Joanne Gabrynowicz, space law and policy; and Dr. Grady Blount, remote sensing and planetary geology. These original faculty members taught classes on campus and at the Grand Forks and Minot Air Force Bases. In 1990, Dr. Charles A. Wood, then of the NASA Johnson Space Center, became chair of the Department and brought several educational innovations to fruition including increased use of the Internet. By 1996, the Department of Space Studies began offering classes through online learning via
http://www.space.edu. Online learning has been extremely successful, and in 1998 the Department of Space Studies became the largest graduate program at the University of North Dakota.

Today, the Department of Space Studies has ~25 students on campus and ~100 students in the online program. Over 750 Master of Science Degrees in Space Studies have been awarded since the Department’s inception in 1987. Space Studies graduates have careers in a variety of different space-related disciplines including government, management, science, law, medicine, education, military, and public relations.

Two faculty members, Dr. Mike Gaffey and Dr. Santhosh Seelan, have been honored with the title of “Chester Fritz Distinguished Professor” by demonstrating achievement across research, teaching, and service with significant national or regional recognition. The department has also been awarded the UND Departmental Excellence in Teaching award in both 2005 and 2015. Dr. Mike Gaffey received the UND Faculty Achievement Award for Excellence in Research in 2005. His research also earned him the rare honor of being awarded both the Leonard Medal and the G. K. Gilbert Award in 2006, for his outstanding contributions to the fields of planetary geology and the science of meteoritics.

The most important thing to remember is that the faculty and staff are here to help you succeed and excel. If you need help or information, ask for it. Faculty doors are also open to speak with you at any time, so please take advantage of our faculty’s expertise and guidance. Also, you are encouraged to participate actively in Departmental activities, such as seminars, colloquia, and student organizations. Online students are encouraged to maintain regular e-mail contacts with their advisors and other Space Studies faculty members. We endeavor to foster a vibrant community of learning, debate, and discussion that will help the students of today become the leaders of the space industry tomorrow.

JOHN D. ODEGARD SCHOOL OF AEROSPACE SCIENCES
As a student in the Department of Space Studies, you are also a major part of the John D. Odegard School of Aerospace Sciences. Named after its founder, the school has grown from an operation of three instructors and two aircraft in 1968 to a complex of seven buildings and other flight facilities on the UND campus and at the Grand Forks International Airport. More than 1500 students are enrolled in the school’s Departments of Aviation, Atmospheric Science, Computer Science, Space Studies and Earth System Science and Policy. The school’s campus facilities include: Odegard Hall with classrooms, altitude chamber, Atmospherium, and administration; Streibel Hall that houses the Computer Science Department; Clifford Hall housing the Space Studies, Atmospheric Science and Earth System Science and Policy departments as well as the Scientific Computing Center and the Upper Midwest Aerospace Consortium (UMAC) and Aerospace Network (ASN); Ryan Hall with aircraft and spacecraft simulators, and classrooms; and Robin Hall, housing the UND Aerospace Foundation, the Center for Unmanned Aircraft Systems (UAS), and classrooms. You will have the opportunity to attend classes and lectures in all of these facilities. The Department of Space Studies is proud to be an important part of the John D. Odegard School of Aerospace Sciences.

STUDENT RESPONSIBILITY
It is the responsibility of the student to become informed and observe all the regulations and procedures required by the University, College of Aerospace Sciences, the student code of life, the current academic catalog, and the space studies program. Ignorance of a rule does not constitute a basis for waiving that rule.
READ THE SCHOOL OF GRADUATE STUDIES CATALOG AND SEEK ADVICE
The UND Academic Catalog serves as the contract between students and UND regarding academic and programmatic requirements. The catalog can be obtained by writing to the Graduate School or accessed at http://und.edu/academics/registrar/catalog-current.cfm. Please contact your advisor or the director of graduate studies at any time for advice and guidance as to Space Studies program requirements and expectations. Also, you should be aware of the UND Code of Student Life at http://und.edu/code-of-student-life/. This code deals with all matters related to University policies, academic concerns, including academic honesty issues, and academic grievance procedures.

WWW.SPACE.EDU HOMEPAGE
A number of links, career information, and class notifications are found on the Space Studies home page on the Internet. Our address is http://www.space.edu. At this URL, you will find useful information regarding administrative matters, classrooms, class schedules, faculty and staff information, and a One-Stop Student Services link at http://space.edu/Academic%20Programs/Onestop.aspx. Feel free to browse through these areas and if you have any suggestions for improvement, please let us know.

FACULTY
Detailed biographical sketches of the current Space Studies faculty members are located at http://www.space.edu/People/Faculty.aspx, but a brief listing with major faculty interest areas is provided below.

James Casler, Ph.D., Professor and Chair; Director, North Dakota Space Grant; and Director, ND NASA EPSCoR
Economics and management, space commerce, space- and planetary-based manufacturing systems and crew design.

Michael Dodge, J.D., LL.M., Assistant Professor and Director, Graduate Studies
International space law, United States space law, general international law, space policy & history, remote sensing law, international aviation law, United States aviation law & regulation.

Ron Fevig, Ph.D., Associate Professor
Orbital mechanics, space mission design, small spacecraft development, high-altitude balloon and sounding rocket payload development, space communications and ground station operations, physical studies of asteroids and comets.

Sherry Fieber-Beyer, Ph.D., Research Assistant Professor
Asteroid spectral investigations to test detailed models of the nature, origin, dynamics and inter-relationships of asteroids, meteorites, and early solar system conditions and processes.

Michael Gaffey, Ph.D., Chester Fritz Distinguished Professor
Planetary geology, asteroids and meteorites, telescopic observations and spectroscopy, early history of the solar system, space resources, origin of life on Earth, and dinosaurs, impacts and extinctions.

Pablo de León, Ph.D. Professor and Director, Human Spaceflight Lab
Human spaceflight systems, planetary space suit research and development, history of the manned space program.
ADJUNCT FACULTY
Adjunct faculty are involved with the Space Studies program in a variety of ways, which includes instructing specialized space-related courses, mentoring students, and advising for student research projects. Detailed biographical sketches of the current Space Studies adjunct faculty members are located at http://space.edu/People/AdjunctFaculty.aspx, but a brief listing with major faculty interest areas is provided below.

K.S. Balasubramaniam, Ph.D., Associate Astronomer, National Solar Observatory, Sunspot, NM
Structure and evolution of solar magnetic fields; Solar activity; Stokes spectropolarimetry, polarized radiative transfer and dynamics of magnetic fields in solar atmosphere; Solar sources of space weather; Solar telescopes and Instrumentation for high-resolution imaging, spectropolarimetry, and synoptic imaging.

Patrick Ford, Ph.D., Chief Scientist, Erevno Aerospace; Director, Spaceport Northwest
Mars Exploration Concepts (in collaboration with Dr. Buzz Aldrin), Commercial spaceflight methods and concepts (as part of volunteer work with Spaceport Northwest, Moses Lake, WA); Advanced tactical airborne avionics systems; Unmanned Aerial Vehicle (UAV) remote sensing systems.

Holly Gilbert, Ph.D., Chief, Solar Physics Laboratory in the Heliophysics Science Division at NASA’s Goddard Space Flight Center
Solar atmosphere and phenomena associated with coronal mass ejections (CMEs), such as prominences and global waves.

Warren Jensen, M.D. Professor, Department of Aviation, UND
Aviation medicine, human factors, flight physiology, decision making in emergency settings, and oxygen delivery systems.

David Livingston, DBA, Founder and host, The Space Show
Space commerce, space economics, ethics, entrepreneurship, and small business management. The Space Show (http://www.thespaceshow.com/), is a radio talk show focusing on increasing space commerce, developing space tourism, and facilitating our move to a space-faring economy and culture.

Bradley Rundquist, Ph.D., Professor, Department of Geography, UND; Administrative Fellow for Research, Arts and Sciences, UND
Remote sensing, spectral characterization of vegetation, remote sensing outreach and workforce development.

Prasad Thenkabail, Ph.D., Research Geographer, U.S. Geological Survey (USGS)
International expert in remote sensing and geographic information systems (RS/GIS) and their application to agriculture, wetlands, natural resource management, water resources, forests, sustainable development, environmental studies, hyperspectral remote sensing of vegetation, global Irrigated and rain fed cropland mapping.

Joseph J. Vacek, J.D., Associate Professor, Department of Aviation, UND
Unmanned aerial systems law, including regulation, policy, privacy, and cybersecurity issues.
INSTRUCTORS
The following instructors teach courses on a needful basis.

David Kugler, Ph.D.
National security policy, military space programs, ballistic missile defense, nuclear weapons policy and strategy, public administration.

Travis Nelson, M.S.
Human factors of spaceflight operations, human performance, and Lunar and Martian analog mission research associate.

STAFF
The following members of the Department of Space Studies staff are here to assist you in your pursuit of a Master’s Degree.

Kathy Borgen, Graphic Designer

Bev Fetter, Administrative Assistant

Caitlin Nolby, M.S. Space Studies (2012), Deputy Director, North Dakota Space Grant Consortium

Pam Nielsen, Office Assistant

Marissa Saad, M.S. Space Studies (2014), Coordinator, North Dakota Space Grant Consortium
ADMISSION REQUIREMENTS
The requirements for admission to the Space Studies M.S. degree program are as follows:

1. Bachelor’s degree from an accredited college or university with an overall grade point average (GPA) of 2.75 or better, or a GPA of at least 3.0 for the junior and senior years of undergraduate work.
2. Three credits of coursework in statistics, algebra, calculus, or computer science.
3. Six credits of coursework in the physical sciences, life sciences, or engineering.
4. Six credits of coursework in the social sciences, history, management, or law.
5. Three credits of coursework in English composition or technical writing.
6. Pre-requisite courses from 2 to 5 above must have been completed at college level, preferably with a grade of B or higher.
7. Take the Graduate Record Examination (GRE) General Exam if you plan on seeking funding (GRAs, GTAs, tuition waivers) via the department or a faculty member. Otherwise, it is not required for admission to the MS program.
8. Submission of a written statement of interest highlighting the candidate’s interest in space studies and motivation to undertake this program. This is the same as the graduate school’s requirement of a statement of purpose.
9. All non-native speakers of English are required to submit the Test of English as a Foreign Language (TOEFL). Applicants must achieve a minimum score of 550 (paper-based), 213 (computer-based) or for the Internet based TOEFL the minimum scores for each category as follows:
   An overall score of 76 is required on the TOEFL iBT for International students applying to graduate school at UND. The minimum scores for each of the subtests on the TOEFL iBT are listed below.
   
   **Graduate Teaching Assistants**
   - Speaking – 26/30
   - Listening – 19/30
   - Reading – 19/30
   - Writing – 17/30

   **Non-Graduate Teaching Assistants**
   - Speaking – 21
   - Listening – 19
   - Reading – 19
   - Writing – 17

   UND recognizes the IELTS test with a minimum overall band score of 6.5 or successful completion of English Language Service (ELS) level 112 as equivalent to TOEFL. This test must be sent directly from ETS; photocopies are not acceptable. The TOEFL requirement will not be waived for any reason, and test scores older than two years are no longer valid. Students with marginally lower score can, however, be admitted on a provisional basis at the discretion of the department and graduate school but will be required to retake TOEFL and obtain the minimum required score in order to be moved to approved status (see below for what this status means). Applicants who have received a bachelor’s degree or higher from the United States or English-speaking Canada are not required to fulfill the English test requirement.
ADMISSION DEADLINES
Unlike many graduate degree programs that process applications for admission once per year for the Fall Semester, the Department of Space Studies processes applications for admission throughout the year, allowing students that are accepted into the program to begin their studies in any semester. The deadlines for applying for admission for each semester are as follows: April 30 for the Fall Semester, October 31 for Spring Semester, and February 28 for Summer Semester. All application materials, including transcripts and recommendations, must be received by the UND School of Graduate Studies by each of these dates in order to be considered for a given semester. The deadline for applying for financial aid through the Department of Space Studies during a given semester coincides with these dates. Note that most departmental financial aid, especially in the form of tuition waivers, is awarded shortly after applications for Fall Semester admission are processed.

ADMISSION STATUS
Applicants for a Master of Science Degree in Space Studies are admitted on an approved, qualified, provisional, or non-degree status.

Approved
Students who have met the minimum admission requirements stipulated by the School of Graduate Studies and the Department of Space Studies are granted admission to approved status. This does not guarantee that a student will be allowed to become a candidate for a degree or a diploma. A student must be on approved status before the first day of classes in the semester in which the student wishes to graduate.

Qualified
Students who have met all requirements except prerequisite coursework are admitted to this status. Students must complete prerequisite coursework by the end of the second term of registration.

Provisional
Students who have failed to meet one or more of the admission requirements are granted provisional admission. Students must make every effort to meet all the conditions specified at the time of admission. Students admitted to provisional status because of a low Grade Point Average (GPA) will be eligible for advancement to approved status after the completion of 9 semester credits if their GPA for all courses attempted is at least 3.0. Students on provisional status may be dismissed after one semester if their GPA is below 3.0, or if they have failed to meet other specified conditions.

Non-Degree Status
Students who have not applied or been accepted into the graduate degree program but want to take graduate courses are classified as non-degree students. Applicants for this status must possess either a bachelor’s degree or different graduate degree (M.S., Ph.D.) from an accredited institution. Subject to approval of the Department and the Dean of the School of Graduate Studies, a maximum of 9 semester credits taken as a graduate non-degree student may subsequently be counted toward a graduate degree subject to meeting all other admission requirements. Students who intend to seek a M.S degree in Space Studies should apply for admission to the program before completing 9 semester credits as a non-degree student. However, it must be noted that taking courses as a non-degree student is not a guarantee for admission. Non-degree applicants are only required to submit the online application and the $35 application fee. No additional documents, including transcripts and recommendation letters are required.
I’M ACCEPTED……WHAT’S NEXT????

This is one of the most commonly asked questions by new students, so this page has been designed to help you through the many steps involved in getting ready to begin your studies.

International students should visit the International Student Services website for more information on issues such as applying for a student VISA, coming to campus, etc.

Right after you receive your acceptance letter from the Graduate School…..

☐ Accept your admission offer at My GradSpace. Be sure to review all stipulations of your acceptance.
☐ Review the Graduate School online orientation as a guide for incoming graduate students. Or register for the Space Studies on-campus orientation held prior to the start of each fall semester.
☐ Claim your U-Mail account.
☐ Claim your CampusConnection account.
☐ Submit mandatory Health History & Immunization form – online students are exempt.

☐ Before you begin…..
☐ For online classroom access, log in to eZ LMS using your Campus Connection username and password.
☐ Use the class schedules to review available courses and chat session schedule.
☐ Register for classes at CampusConnection. Review the navigation help for more info.
☐ Order textbooks. Textbooks are available at the UND Bookstore for on-campus students. Online students may purchase textbooks from the online bookseller of their choice using the textbook requirements posted in the course description within the class schedule.
☐ Request access to the online classroom in eZ.
☐ Test the chat room access in the online classroom once your pending request is approved.
☐ Apply for on-campus housing if needed.
☐ Apply for a meal plan if needed.
☐ Explore the tuition payment plans.
☐ Review Space Studies Student Handbook.

☐ When you begin the semester…..
☐ Apply for a student ID card – optional for online students.
☐ Purchase a student parking permit for on-campus parking.
☐ Pay tuition. Obtain your tuition charges via CampusConnection: Student Center>Account Summary.
☐ Review Space Studies Calendar and News.
STUDENT LEARNING OBJECTIVES
Appropriate outcomes for each student are determined individually through consultation and collaboration with the primary advisor who directs the student’s program. Appropriate outcomes are determined based on student background, career goals, availability of resources, and appropriate focus.

In general, the student learning goals of the Master of Science program are that the student:

Possesses both multidisciplinary and interdisciplinary knowledge of space enterprises.

Objective 1: Demonstrates the correct and effective use of the terminology and concepts of a broad range of space-related fields, to include social sciences, as well as technical disciplines.

Objective 2: Demonstrates an understanding of the interrelationships between the technical and social aspects of space enterprises by effectively applying this knowledge to problem-solving.

Objective 3: Demonstrates effective critical thinking and problem-solving in space-related fields through oral and written communication.

Objective 4: Demonstrates effective problem-solving and decision-making in an interdisciplinary team environment.

Possesses knowledge of one of the following space-related disciplines: management, history, policy, law, engineering, human factors, applications, or planetary science.

Objective 5: Demonstrates the correct and effective use of the terminology and concepts of one or more space-related disciplines.

Objective 6: Demonstrates effective participation in either independent or faculty research projects to advance the body of knowledge of space enterprise.

DEGREE REQUIREMENTS
All students are required to complete a minimum of 33 credits. The following plan should be used:

1. **SpSt 501** Survey of Space Studies I and **SpSt 502** Survey of Space Studies II (6 credits).
2. Students select either the non-thesis or thesis option and declare which social or technical area is their area of specialization. This is the area in which they do their **SpSt 997** Independent Study Report or **SpSt 998** Thesis.
3. Two (2) courses from designated social area courses outside the student’s area of specialization (6 credits).
4. Two (2) courses from designated technical area courses outside the student’s area of specialization (6 credits).
   Note: The choice of courses in the required social and technical areas outside the student’s area of specialization must take into account the breadth of disciplines, which is a critical part of Space Studies education. In order to meet the breadth requirements within the degree options, students are required to spread their courses as per guidelines outlined in the Department of Space Studies Graduate Student Handbook.
5. One credit of **SpSt 590** Space Studies Colloquium (1 credit).
6. At least half of the total credit hours must be from classes at the 500-level and above.
Non-Thesis Option
2. Comprehensive Examination.
3. At least 3 elective courses.
4. All non-thesis students must complete SpSt 595 Space Studies Capstone (3 credits).

Thesis Option
1. SpSt 593 Individual Research in Space Studies (1 to 3 credits).
2. SpSt 998 Thesis (6 credits).
3. At least 2 elective courses.
4. Submission of the thesis, or an article derived therefrom, to a peer-reviewed journal.

Approval of the thesis option will only be granted if a clear alignment of research interests between a faculty member and a student is demonstrated, and a faculty adviser has been identified and is available to supervise the research. Online students who wish to complete the thesis option must demonstrate access to facilities needed for the research and must satisfy the residence requirement. Interested students should consult the School of Graduate Studies or department.

The following charts list the requirements and semester credits for each option.

**THESIS OPTION**
33 credits to include:
- SpSt 501 and SpSt 502 (6 cr.)
- SpSt 590 (1 cr.)
- Two courses from designated social area outside the student’s area of specialization (6 cr.)
- Two courses from designated technical area outside the student’s area of specialization (6 cr.)
- At least two additional elective courses (6 cr.)
- SpSt 593 (2 cr.)
- SpSt 998 (6 cr.)

**NON-THESIS OPTION**
33 credits to include:
- SpSt 501 and SpSt 502 (6 cr.)
- SpSt 590 (1 cr.)
- Two courses from designated social area outside the student’s area of specialization (6 cr.)
- Two courses from designated technical area outside the student’s area of specialization (6 cr.)
- At least three additional elective courses (9 cr.)
- SpSt 595 Capstone (3 cr.)
- SpSt 997 (2 cr.)
- Comprehensive examination

**Residency**
Online students pursuing the non-thesis option must spend a minimum of one week on the UND campus during the capstone experience in spring. A campus student who chooses the thesis option must spend a minimum of one semester or two summer sessions in residence on the UND campus. The thesis option for online students requires a minimum of one academic week of residency at UND per semester beginning with the semester of the student’s thesis proposal presentation.
STUDENT PROGRESS CHECKLIST
The Department of Space Studies provides a Student Progress Checklist to guide students through the necessary steps toward graduation. It can be found on the One Stop Student Services page under forms at http://space.edu/Academic%20Programs/Onestop.aspx. This is a very helpful guide as you continue through your program---refer to it often.

COURSE LISTING

500. Introduction to Orbital Mechanics. 3 credits. This course introduces students without much background in either mathematics or physics to the problems faced everyday by orbital analysts as they track the 7000 satellites which orbit the earth. The course gives the students an ability to converse, as managers and co-workers, with those individuals who are calculating these difficult orbits. This appreciation is important in both the civilian and military sides of the space program.

501. Survey of Space Studies I. 3 credits. SpSt 501 is the first course in a two-course sequence (along with SpSt 502) in Space Studies that introduces new students to essential knowledge that will be necessary to successfully complete their M.S. degree in space studies. SpSt 501 consists of the following six modules: 1) space history, 2) space policy, 3) space law, 4) planetary and space sciences, 5) space life sciences and human factors, and 6) Earth remote sensing. All modules contain foundational information that will give students the basic knowledge and skills necessary to achieve a broad understanding of the multi- and interdisciplinary nature of space studies; knowledge that can be applied in later courses, such as Capstone; and knowledge that facilitates thesis and other specialized types of instruction and research. Course content in SpSt 501 will also be used to assess student learning at the end of their M.S. program via the Comprehensive Examination. Students are expected to master and understand course content, be able to apply course content as appropriate, and demonstrate their understanding of course content prior to graduation. Fall.

502. Survey of Space Studies II. 3 credits. SpSt 502 is the second course in a two-course sequence (along with SpSt 501) in Space Studies that introduces new students to essential knowledge that will be necessary to successfully complete their M.S. degree in space studies. SpSt 502 consists of the following five modules: 1) space mission design (two modules), 2) orbital mechanics, 3) launch vehicles and propulsion, and 4) robotic spacecraft instrumentation. All modules contain foundational information that will give students the basic knowledge and skills necessary to achieve a broad understanding of the multi- and interdisciplinary nature of space studies; knowledge that can be applied in later courses, such as Capstone; and knowledge that facilitates thesis and other specialized types of instruction and research. Course content in SpSt 502 will also be used to assess student learning at the end of their M.S. program via the Comprehensive Examination. Students are expected to master and understand course content, be able to apply course content as appropriate, and demonstrate their understanding of course content prior to graduation. Spring.

505. Spacecraft Systems Engineering. 3 credits. This course will guide the students through the spacecraft design and proposal process for an actual mission. In this course the students will work in teams on individual spacecraft subsystems, participate in an engineering design review, and create a document which can be submitted for funding for a small satellite project. Lectures will provide an overview of the separate spacecraft subsystems involved in a typical mission, the systems engineering approach to spacecraft development, and the grant writing process. Online students will interact with on-campus students via conferencing software. Prerequisite: SpSt 405 or consent of instructor.

506. Advanced Orbital Mechanics. 3 credits. This course provides a working knowledge of the field of orbital mechanics including the use of appropriate mathematical and computational techniques, the analysis of professional papers in orbital mechanics, and applying the appropriate techniques to solve orbital mechanics problems. Topics covered include orbital elements, perturbations, coordinate
systems, orbit determination, and multi-body gravitational problems. Prerequisites: SpSt 500 and MATH 266 or equivalent.

508. Quality Engineering for the Space Industry. 3 credits. This course addresses the principles and techniques for establishing quality goals, identification of customer needs and requirements, measurement of quality, and product/process engineering to improve system performance with a focus on the space industry. The main objectives are to provide the student with an understanding of the principles and practice of quality and reliability engineering in general and to provide an in-depth understanding of the quality assurance concepts, strategies, and tools practiced in the space industry. Familiarity with the techniques learned in this course will enable the student to address problems in the design, implementation, measurement, and correction of production and service systems found in the space industry.

512. Human Performance in Extreme Environments. 3 credits. This course identifies the impact that the stressors of extreme environments have on human performance. The course objectives are to highlight the differences and similarities among extreme environments and to demonstrate that, despite the differences lessons learned from operations in a given extreme environment can be effectively applied to other environments. Although settings such as space, mountains, or deep sea exhibit unique characteristics, the human physiological and psychological reactions and adaptations to these extreme settings stay similar.

515. Human Factors in Space. 3 credits. This course is a review of the major stresses experienced by humans on entering the space environment. The course objectives include investigation of the psychological and physiological effects experienced by U.S. and Russian space crews, with an emphasis on longer flights. The examination of the avoidance and mitigation of these stresses is an essential need in the future development of human spaceflight.

517. Human Spaceflight Systems. 3 credits. This course is designed to introduce students to human space systems. The course uses both an engineering and a historical approach to human spaceflight systems covering all manned spacecraft up to today, plus individual subsystems necessary for human occupation. By the end of the course, students will: 1. Understand the engineering and science concepts related to human spaceflight, 2. Understand the major technologies required for human spaceflight, 3. Apply the systems engineering process to a human spaceflight mission: a. Describe the interactions among the elements of a space mission, b. Describe the interactions among all spacecraft subsystems, c. Document design decisions and analysis in a clear and concise manner.

519. Closed Ecological Systems for Life Support. 3 credits. The course covers the multiple interactions of human/bio-regenerative life support based on physical/chemical regeneration (hybrid) life support environments. The course devotes specific attention to the limits of stability for closed material cycles functioning during long-term remote confined missions. The importance of the human factor as a target link, main sensor, and main integration and control element for the system is considered as providing significant self-sustainability. Advanced scenarios for space life support based on ecological and in situ resource utilization approaches are discussed.

520. Asteroids, Meteorites and Comets. 3 credits. The small bodies of the solar system provide clues to the origin and early history of the solar system. The planets and larger moons have all been chemically transformed, erasing the records of their formation. By contrast, many asteroids, meteorites and comets are essentially unmodified from the time of their origin 4.5 billion years ago, and thus preserve a record of the formation epoch. Each of these classes of objects is investigated separately, and relationships between them are examined. Implications for impact hazards and for extraterritorial resources are also explored. The results of recent and current spacecraft missions to asteroids (e.g., Galileo, NEAR, DAWN, Hayabusa, Rosetta, OSIRIS-Rex, etc.) and to comets (e.g. Giotto, Vega 1, Stardust, Deep Impact, Rosetta, etc.) are reviewed.
521. The Planet Mars. 3 credits. This course provides an in-depth review of the present state of our knowledge of Mars. Topics to be covered include: the origin and evolution of the planet, the surface geology and geological processes, the geophysical properties of the Martian interior, the origin and evolution of the Martian atmosphere, the present and past climates of Mars, the Martian moons, and the possibility of past or present life on Mars. The American and Soviet/Russian Mars exploration programs are reviewed and the course incorporates the most recent results from spacecraft missions such as Mars Global Surveyor, Mars Odyssey, the Mars Exploration Rovers, Mars Reconnaissance Orbiter, and Mars Science Laboratory (Curiosity Rover). Potential future manned and unmanned missions are also discussed.

522. Remote Sensing Principles. 3 credits. This course covers the basic concepts and foundations of remote sensing, a review of major Earth observing satellite and aircraft platforms, and an investigation of flow of data from satellite to Earth, what it represents, and how to interpret it, using both visual and digital image processing techniques. A field visit to the EROS Data Center in Sioux Falls may also be arranged.

523. Remote Sensing Applications. 3 credits. This course covers the use of advanced image processing algorithms and information extraction techniques for various Earth resource applications such as land cover/land use, environmental change detection, geology, oceanography, agriculture, forestry, rangeland, water resources, urban planning, natural disaster management, etc. Prerequisite: SpSt 522.

524. Current Topics in Astrobiology. 3 credits. This is a multi-disciplinary, literature-intensive examination of astrobiology, which is the study of life in the universe. Students will read scientific research and review papers from a variety of disciplines including astronomy, planetary science, chemistry, biology, and geology. Course goals include: developing proficiency at reading/analyzing diverse scientific papers, developing the ability to incorporate knowledge from multiple disciplines in the study of astrobiological research, and developing the ability to effectively write summary papers to show basic understanding of course material. Prerequisite: SpSt 460 or consent of instructor.

525. Technical Issues in Space. 1-3 credits. An examination of the technological base for the exploration and development of space. An understanding of this technology and of its impact is essential to an understanding of the issues and problems associated with our continuing efforts to explore and settle this new frontier. May be repeated if the topic is different. Repeatable.

526. Astronomical and Spacecraft Instrumentation. 3 credits. This course will concentrate on instrument design, operation, and the resulting data products generated by ground- and space-based astronomical observatories, as well as common instrumentation used in NASA scientific solar system spacecraft. Key goals for this course include gaining a solid understanding of instrumental principles of operation, the types of raw data that are generated, and the types of data reduction processes that lead to interpretable data. The course will include an investigation of different types of spectrographs and spectroscopy data products, solar instrumentation (ground- and space-based), terrestrial and Jovian spacecraft orbiter/flyby instrumentation, terrestrial planet rover and lander instrumentation, and extrasolar system astrophysical instrumentation. Students will have the opportunity to examine, reduce, and interpret select data sets. Prerequisites: SpSt 425 and MATH 165 or consent of instructor.

527. Extraterrestrial Resources. 3 credits. This course focuses on the inventory, accessibility, acquisition, processing and utilization of extraterrestrial resources (space resources) from celestial bodies such as the Moon, Mars, asteroids and comets. Consideration will be given to extraterrestrial resources for in situ utilization (such as a Lunar or Martian base), for space operations (such as supporting large scale near-Earth activities or a human Mars mission), and for terrestrial markets. The course will focus on the interplay between the scientific, technical, and economic aspects of acquiring and utilizing such resources. The course will also explore some of the legal and political ramifications and limitations of claiming and recovering space resources.
528. **Space Environment and the Sun.** 3 credits. This course will provide an in-depth study of the science and observations of the Sun, space weather, and effects of the Sun on astronauts, Earth, and the space environment. Topics that will be covered include the solar photosphere and active surface phenomena such as sunspots, flares, and coronal mass ejections; the nature of the quiet Sun; the solar interior and helioseismology; space weather and impact of solar particles on the space environment and Earth; the hazards posed to astronauts by solar eruptions; common techniques of solar observations; and a review of the primary types of solar instrumentation and the observatories that currently study the Sun. Students will be able to observe the Sun using the UND Observatory's small solar telescopes; all students will have the opportunity to analyze solar datasets to aid their understanding of the Sun. Prerequisite: MATH 165 or consent of instructor.

540. **Space Economics and Commerce.** 3 credits. A study of the economic aspects of space activities, with analysis of the possibilities and the barriers. Key areas include launch services, satellite communications, remote sensing, microgravity materials processing, and interaction with the government. Global competition against subsidies or government-sponsored entities is examined.

541. **Management of Space Enterprises.** 3 credits. This course investigates the management of space organizations. These include organizations that are public and private, R&D and operations, profit and non-profit. You will learn the basics of management theory, the history of systems management, and the technical issues that must be considered in the management of space R&D and operations.

542. **Risk Management of Space Organizations.** 3 credits. This course includes a systematic approach to the principles and practices of risk management in the space industry from project initiation through planning, implementation, control and closeout. It discusses various techniques and models for qualitative and quantitative risk assessment and risk mitigation in such areas as cost, schedule, and performance. Decision making under conditions of uncertainty and risk is also discussed.

545. **Space and the Environment.** 3 credits. This course is an advanced graduate-level review of international relations theories as applied to the international implications of global commons. The course introduces the concept of global commons, examines the theories and practices concerning management of global commons, and analyzes the global commons dealing with the problems of collective action as applied to global environmental change and the uses of outer space.

551. **History of the Space Age.** 3 credits. This course introduces students to the history of human endeavors in space. These include the development of rocketry, the influence of amateur societies and science fiction, the military development of ballistic missiles, and human and robotic spaceflight.

552. **History of Astronomy and Cosmology.** 3 credits. This course investigates the history of human endeavors to understand the stars, planets, and cosmos as a whole from a scientific perspective. It covers the early observations and theories of the Babylonians and Greeks through the European Scientific Revolution, and finally to the development of astrophysics and modern cosmology using space vehicles.

555. **Military Space Programs.** 3 credits. An introduction to military uses of space by the United States, Russia, and other nations. The course introduces ballistic missiles, anti-ballistic missile and anti-satellite systems, space-based reconnaissance and intelligence-gathering, communications, navigation, acquisition, and military space treaties.

560. **Space Politics and Policy.** 3 credits. This course serves as a graduate-level introduction to the field of Public Policy as applied to Space Policy. The course surveys the evolution of Space Policy at several levels of analysis including context, political actors and institutions, political processes, and policy outcomes, and assesses the symbiotic relationship between policy, technology, and science.

561. **Public Administration of Space Technology.** 3 credits. This course is an advanced graduate-level review of Public Administration theories as applied to the implementation of space technology.
programs. In this course, the political, organizational, and technical variables that affect the management processes of space organizations are examined. Prerequisite: SpSt 560 or SpSt 541.

565. Space Law. 3 credits. This course serves as a graduate-level introduction to the field of Law as applied to Space Law. The course examines the origins and evolution of the laws of outer space from the beginnings of the space age to the present. International laws governing access and use of space, and national laws regulating governmental and commercial activities in space are reviewed and analyzed.

570. Advanced Topics in Space Studies. 1 to 3 credits. Lecture, discussion and readings on advanced topics of current interest. May be repeated if the topic is different. Repeatable.

574. Remote Sensing in Developing Countries. 3 credits. This course will introduce students to remote sensing programs in developing countries and typical remote sensing application areas pertinent to developing countries, such as: potable water, forest fires, vector diseases, environmental degradation, food security, fisheries, floods, droughts, crop pests, etc., with case studies. Prerequisite: SpSt 522 or GEOG 475 or consent of instructor.

575. Remote Sensing Law and Policy. 3 credits. This course focuses on the evolving laws, policies, and institutions that have long-term ramifications for earth observations. Some topics addressed are the United Nations Principles on Remote Sensing; the United Kingdom's 1984 National remote sensing policy; the Montreal Protocol; and, the United States Land Remote Sensing Policy Act of 1992. Ground segment institutions considered are the Landsat Ground Stations Operations Working Group and the Global Land 1-KM AVHRR Project. Remote sensing litigation that has begun to address various applications of remote sensing will also be considered. Cases include Dow vs US and EOSAT vs NASA and NOAA.

581. Field Visit to Space Centers. 1 to 3 credits. This course will provide a first-hand knowledge of selected space centers in the U.S. and/or abroad through an organized field visit. The field visit will be led by a space studies faculty and will include prior preparation through readings, class seminars, lectures and written assignments. May be repeated up to a maximum of 3 credits. Repeatable to 3 credits. S/U grading.

590. Space Studies Colloquium. 1 credit. A series of lectures presented by visiting lecturers and faculty. May be repeated for up to 2 credits. S/U grading.

593. Individual Research in Space Studies. 1 to 3 credits. Individual student projects designed to develop advanced knowledge in a specific area of expertise. A written report is required. May be repeated for up to 6 credits for Master's and up to 12 credits for Ph.D.

595. Space Studies Capstone. 3 credits. The capstone course integrates, extends, and applies knowledge gained in earlier Space Studies courses and reading. The major component of this course is a collaborative team project inter-relating policy, technology, and science. This course is required for online students who select the non-thesis option and can be taken after completing at least 21 credits in the program or with the permission of the instructor. The course begins in the fall semester and concludes with a required week-long capstone experience on the UND campus in the spring. Prerequisites: SpSt 501 and SpSt 502. Fall.


998. Thesis. 1-6 credits. An original research project approved by and completed under the supervision of a thesis committee. Repeatable to 6 credits. Prerequisites: Graduate standing in Space Studies and completion and approval of a thesis proposal (see department for approval).
In addition, the following 400 level courses can be taken for graduate credit. Please note: courses with SpSt 200 as a pre-requisite will require a special permission number to override this requirement.

405. Space Mission Design. 3 credits. A team design project to develop the requirements for a space mission. The specific mission will vary from time to time. Design teams will work on selected portions of the mission. Accompanying lectures will provide background material. Prerequisite: SpSt 200. (Waived for graduate students.)

410. Life Support Systems. 3 credits. This course is a review of the physiological effects of living in space including a discussion of current and near-term life support systems equipment for the provision of oxygen, water, food, and radiation protection. In addition, a review will be made of the issues associated with the development of fully closed ecological life-support systems that will be essential to the long-term development of space. Prerequisite: SpSt 200. (Waived for graduate students.)

425. Observational Astronomy. 3 credits. This course provides an introduction to observational astronomy and includes three segments: basic observing techniques and astronomical equipment (telescopes, CCDS); visual observing and the characteristics of the night sky; astrometric and photometric observing, data reduction, and interpretations; and image processing and color imaging techniques. Students will learn to operate a remotely controllable Internet telescope and CCD camera. A broadband Internet connection is recommended. Night observing is required. Course fee. Prerequisite: PHYS 110.

430. Earth System Science. 3 credits. This course begins with a review of the physical sciences of geology, meteorology, and oceanography to examine the coupled interactions between the land, atmosphere and oceans. Particular emphasis is placed on remote sensing techniques for global monitoring of biogeochemical processes. The role of human activities on Earth processes and the consequences of global environmental changes are discussed. The growing use of space-based data sets and the implications of Earth Observing System technologies, including research goals and hardware requirements, are examined. Prerequisite: SpSt 200. (Waived for graduate students.)

435. Global Change. 3 credits. The current human population represents something unprecedented in the history of the world. Never before has one species had such a great impact on the environment in such a short time and continued to increase at such a rapid rate. Human activities are therefore significantly influencing the Earth's environment in many ways in addition to greenhouse gas emissions and climate change. Anthropogenic changes to Earth's land surfaces, oceans, coasts, and atmosphere and to biological diversity, the water cycle and biogeochemical cycles are clearly identifiable beyond natural variability. This course investigates the many facets of global change issues and attempts to provide an up-to-date introduction to the study of the Earth's environment.

450. International Space Programs. 3 credits. This course will introduce students to the major governmental space programs around the world. The history, activities and future directions of the Russian/Soviet, European/ESA, Chinese, Japanese, Indian and other space programs will be explored. International collaborations between the various programs will also be studied. Prerequisite: SpSt 200. (Waived for graduate students.)

460. Life in the Universe. 3 credits. This course examines the evolution of the universe from its origin to the present: cosmological evolution, chemical evolution, planetary evolution, biological evolution, and cultural evolution. The possibility of life in the universe elsewhere than Earth is considered. Human changes to the Earth are placed within this context.

CONTINUING ENROLMENT (SpSt 996)
Students who previously have registered for all the necessary credits of course work, research, and independent study (SpSt 997) or thesis (SpSt 998) on their approved program of study, but have not yet
completed the SpSt 997 or SpSt 998, must register for SpSt 996 Continuing Enrollment, each additional semester or summer session until completion of the study or thesis. SpSt 996 may be taken for up to 12 credits. However, after two separate semesters of 6 to 12 credits in 996 for Master’s students, a student wishing to enroll in additional SpSt 996 credit will be required to petition the School of Graduate Studies. There will be three credit levels:

- One credit for those students who need to stay active and have access to campus services
- Six credits for those who require part-time status
- Nine credits for those who require full-time status

Students must be enrolled in a course during the semester they graduate. Typically, SpSt 996 is used to meet that UND requirement if all other courses on the student’s program of study have been completed in previous semesters.

Per UND’s Academic Catalog, 996 Continuing Enrollment credits do not count toward a degree and are not eligible for financial aid.

**TECHNICAL AND SOCIAL AREA COURSE DESIGNATIONS**

The following are the various social and technical area courses offered. Please consult the academic catalog and [http://www.space.edu](http://www.space.edu) for course descriptions and course offerings in current and future semesters. If you are particularly interested in a certain course, please consult your advisor to find out when it will be offered next.

**Social area courses:** 450, 508, 540, 541, 542, 545, 551, 552, 555, 560, 561, 565, 575, 574, 581.

**Technical area courses:** 405, 410, 425, 430, 435, 460, 500, 505, 506, 508, 512, 515, 517, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 574.

**Note:** SpSt 570 may count towards either policy or technical area depending on the contents.

The choice of courses in the required social and technical areas outside the student’s area of specialization must take into account the breadth of disciplines, which is a critical part of Space Studies education. Students are advised not to choose more than one course from within the same sub-discipline. As an example, if a student focusing on a technical sub-discipline for his or her area of specialization needed to choose two courses in the social area in order to meet breadth, he or she would be advised to take one of those courses in management, and another in history, rather than taking both courses in history. If a student does desire to take both of their social area courses within the same sub-discipline, he or she should first discuss this with an advisor. In order to meet the breadth requirements within the degree options, students are required to spread their courses as per guidelines below. There may be other courses, not mentioned here, which may fulfill the breadth requirement. Many of the SpSt 570 courses can also fit into the designated social and technical area courses. Please consult your advisor while planning your program of study to ensure that the breadth requirements are met.

The additional courses required to meet the electives in the area of specialization can come from within the same sub-disciplines.

**Designated Social Area Courses**

Management:  SpSt 508 or 540 or 541 or 542 or 561

History:  SpSt 450 or 551 or 552 or 555 or 560
Policy: SpSt 450 or 545 or 555 or 560 or 574 or 581 (if 581 is offered for less than 3 credits, must meet the remaining credits from one of the other policy courses)

Law: SpSt 565 or 575

**Designated Technical Area Courses**

Space Engineering: SpSt 405 or 500 or 505 or 506 or 508 or 517 or 525 or 526

Human Factors: SpSt 410 or 512 or 515 or 519

Applications: SpSt 425 or 515 or 519 or 522 or 523 or 526 or 574

Planetary Science: 430 or 435 or 460 or 520 or 521 or 524 or 527 or 528

SpSt 570 can be considered under any one of the sub disciplines depending on the content. Please check with your advisor and or Graduate Director. SpSt 590 and SpSt 593 DO NOT fall under any of the sub disciplines.

**ONLINE CLASS CHAT SESSIONS**

Online class chat sessions are conducted by the Space Studies faculty in order to provide regularly scheduled, real-time interactions between students and instructors during times when most online students are available (i.e., in the evenings, after normal working hours). Such orchestrated student-student and student-instructor interactions are otherwise unavailable to our online students. These chat sessions are a critical component of online courses since they are carefully crafted by Space Studies faculty to enhance the online learning experience. In order to succeed in online classes, chat session participation by online, and sometimes campus students, is a required component of Space Studies courses. As with all Space Studies courses, requirements for attendance are in accordance with [UND policy](#).

**COURSE ROTATIONS AND SCHEDULES**

Course rotations and schedules can be found at [http://www.space.edu](http://www.space.edu) in the current student menu, or through a link at the One-Stop Student Services webpage. Online class chat session timings are posted within the course description at the course schedule about one month prior to the semester start date.

**COURSE REGISTRATION**

The Campus Connection registration system has been created for your convenience. This system will allow you to register for classes, check for open courses, view and print your schedule, view and print your grades, and drop and add courses through the Internet. To access Campus Connection, go to: [http://www.und.nodak.edu/dept/registrar/campusconnection/index.htm](http://www.und.nodak.edu/dept/registrar/campusconnection/index.htm).

**Special Permission Registration**

UND's Campus Connection registration system may not recognize courses that require department permission or missing pre-requisite overrides. Examples of courses requiring special permission of the department are most 400-level courses, SpSt 593, SpSt 996, SpSt 997 and SpSt 998. Please contact Bev Fetter for special permission numbers when registering for these courses, or to over-ride missing pre-requisites for other courses. You will be given a student-specific number for successful course registration.

**COURSE DROP AND WITHDRAWAL POLICIES**

A 100% credit is automatically posted to your Campus Connection account ONLY during the first 9% of the semester for which you have dropped a class. Students will be responsible for 100% of the tuition and fees charged for courses that are dropped after the first 9% of the semester. Courses can only be
dropped utilizing Campus Connection before the posted deadline. Drops after this posted date will require a registration action form. Please note: A student cannot drop to zero credits on Campus Connection as this is considered a withdrawal from school.

A student who is registered for classes and wants to drop ALL classes is considered to be withdrawing from school. However, if you do not officially withdraw from school, you will be required to pay for 100% of the tuition and fees charged to your Campus Connection account. **You cannot officially withdraw from school using Campus Connection.** Students MUST complete and submit a withdrawal form to the Office of the Registrar. Please refer to the Registrar’s Office official withdrawal policies at [http://und.edu/finance-operations/student-account-services/withdrawal.cfm](http://und.edu/finance-operations/student-account-services/withdrawal.cfm). Follow the link to submit an electronic cancellation/withdrawal form. This site will also provide dates for pro-rated tuition refunds based on the date of your withdrawal from school.

Students who wish to withdraw from the space studies program completely and will not register again in the future should submit the School of Graduate Studies Request to Withdraw/Change Program form found at [http://graduateschool.und.edu/current-students/forms.cfm in the all student menu](http://graduateschool.und.edu/current-students/forms.cfm). This is in addition to the cancellation/withdrawal form above if you are registered for courses at the time.

**COURSE RESOURCES**

**Access to class website, HTMLeZ**
Each Space Studies course has a website or online classroom where you will find the course syllabus, assignments, collaboration and chat tools, power point presentations, lecture videos and other important course materials. Course websites are powered by the eZ Learning Management System ([https://learn.aero.und.edu/index.asp](https://learn.aero.und.edu/index.asp)) or eZ for short. Instructions for creating a personal account and requesting access to the online classrooms can be found at [http://learn.aero.und.edu/pages.asp?PageID=120089](http://learn.aero.und.edu/pages.asp?PageID=120089). Generally, course websites will be available one week prior to the course start date.

If you face any difficulty or problems with HTMLeZ, please call (701) 777-4688 or submit a trouble ticket online at [https://learn.aero.und.edu/contact-us.asp](https://learn.aero.und.edu/contact-us.asp).

**Chester Fritz Library**
Space Studies online students have access to the resources available at UND’s Chester Fritz Library. The coordinator of online education at the library is Janet Rex, phone: (701) 777-4641, e-mail: janet.rex@library.und.edu. For Chester Fritz Library’s online education services, go to: [http://libguides.und.edu/distance-education](http://libguides.und.edu/distance-education) which gives information on getting/activating your library card, activating your U-Mail account, as well as a lot of links to full-text resources for your studies.

**Textbooks and Lecture DVDs**
Campus students may purchase their course textbooks at the University of North Dakota Bookstore. Textbooks for online students are also available through the UND Bookstore. Textbook information is posted online within the course description at the course schedule webpages at Space.edu in the current student menu. All students may purchase their textbooks through the UND Bookstore, or the supplier of their own choosing.

On request, course lectures on professionally produced DVDs will be shipped about two weeks prior to the course start date to all enrolled students for those courses that have pre-recorded lectures available.
Pre-recorded course lectures will also be available at the class websites for download. Many courses have concurrent campus and online offerings. In such cases, lecture videos are only available in the online classroom.

**SPACE STUDIES COLLOQUIUM**

The goal of the Space Studies Colloquium is to bring guest speakers from the space community from both industry and academia to support space-related scholarship in the Department of Space Studies and at UND and other North Dakota institutions of higher education. Guest researchers will be invited by the Department of Space Studies to give a seminar in their area of professional expertise, guest lecture in existing courses offered through the Department, and consult on space-related research with faculty and students. Guest researchers will be invited from a variety of backgrounds and research areas such as Space Engineering, Space Life Sciences, Planetary Sciences, Astrobiology, Earth System Sciences, and Space Policy. In addition to the Department of Space Studies, guest speakers will interact with faculty, researchers, and students in a number of programs at UND including the Upper Midwest Aerospace Consortium (UMAC), School of Aerospace Sciences, College of Business, and the Departments of Mechanical and Electrical Engineering, Geography, Geology, Physics, and Political Science.

Space Studies students are required to enroll in the Colloquium (SpSt 590 – Space Studies Colloquium) at least one time during the Master’s program. Students will be allowed to enroll for credit for up to two semesters. Students will receive one credit hour for the semester in which they register and will be required to attend the colloquium talks, submit and present summary reports, and attend discussion sessions to reflect on the topics of the colloquiums. It is recommended that students planning to enroll in SpSt 595 Capstone, wait to enroll in SpSt 590 Colloquium until the same year as the Capstone course since the colloquium topic is relevant. Note that funded campus graduate students (i.e., students on graduate assistantships and tuition waivers) are required to attend Colloquium regardless of registration for course credit. The colloquium series is typically offered every spring.

**SPACE STUDIES BROWN BAG LUNCHES**

The department will schedule an informal brown-bag seminar series each fall semester that will give students and faculty the opportunity to share their latest research and educational activities with the department. The seminar is important for students to learn about the research occurring within the department, opportunities to collaborate with existing or new research projects, and as a way to become more integrated into departmental activities. Presentations will be given over the lunch hour and the exact times will be announced each semester. Attendance is mandatory for campus students.

**SPACE STUDIES CAPSTONE**

Capstone (SpSt 595) is a mandatory course for all students in the non-thesis option. It is offered once per year in the fall semester and continues into the spring semester. The philosophy behind Capstone is to bring together online and campus graduate candidates for presentations, seminars, and graduation ceremonies on the UND campus as part of an integrative problem-solving course. To the extent possible, Capstone Week is conducted in the manner of a professional conference.

Capstone can be taken after completing at least 21 credits in the program, including SpSt 501 and SpSt 502, or with the permission of the capstone course instructor and advisor. It is strongly recommended that students planning to graduate in the Spring semester should have completed their comprehensive examination and SpSt 997 before the Spring semester. The Space Studies faculty will provide a reality-based topic area, e.g., respond to a NASA research solicitation. The class is then divided into teams which explore the assigned problem over the course of the Fall and Spring semesters and present their
results during Capstone week. Chat sessions, webpages, and interim report submissions are all part of the Capstone course activities. Students taking Capstone will receive an incomplete grade (“I”) in the fall. This grade is changed to a final grade upon Capstone completion in the spring term.

Capstone Week is held during finals week of the UND spring semester. Attendance at the on-campus capstone week is mandatory. All students must commit to attending the on-campus week early during the fall semester, obtaining employer approval if necessary. Failure to attend can result in failure of the course or lowering of the grade. Exceptions may be made in very rare cases due to reasons such as call for active military duty. On examination of the case presented by the student, exceptions may be granted based on majority vote by faculty at a regularly convened faculty meeting. Upon arrival on campus, candidates will be introduced to their Capstone teammates, Space Studies faculty and staff, and local campus dignitaries. Student teams make their final team presentations, which are then graded by the faculty and by a subject matter expert in the field that has been chosen for the group project. In addition, the candidates who have completed their SpSt 997 will make presentations on their 997 Independent Study Reports. On the final day of Capstone, the candidates for graduation in the spring semester participate in the UND graduation ceremonies and receive their Master of Science in Space Studies.

It is expected that a student who has attended Capstone will complete graduation requirements no later than the fall semester following Capstone. The student’s advisor and the chair of the Department of Space Studies will determine exceptions to this policy.

**GRADUATE STUDENT-INITIATED COURSES (SpSt 593 and SpSt 997)**
The Department of Space Studies offers a variety of classes in the many sub-disciplines of Space Studies. However, due to the integrative, interdisciplinary, and multidisciplinary nature of the program and of the students, it is not always possible to satisfy every student’s need for knowledge in scope or depth. These needs can be facilitated through student-initiated classes.

**Types of Classes**
The Department currently offers two graduate student-initiated classes: 1) SpSt 593: Individual Research in Space Studies – required for graduate students selecting the thesis option and optional for graduate students selecting the non-thesis option; and 2) SpSt 997: Independent Study Report – required for graduate students selecting the non-thesis option.

**Similarities**
Both of these classes share some basic structure. Foremost, is that both of these classes are initiated by the student who wants to further enhance a part of their education that is not addressed in the regularly offered curriculum.

The process works best when the following steps are observed:

1. Student identifies topic.
2. Student does preliminary research into topic to help refine interest.
3. Student identifies advisor for topic.*
4. Student and advisor meet to further define topic, define schedule of completion, and define deliverable(s) due upon completion.*
5. Student and advisor periodically meet (as scheduled and/or as needed).
6. Deliverable(s) completed.*
7. Grade assigned.
Steps marked with an asterisk (*) are often an iterative process between the student and advisor. Iterations often involve making the initial student idea more tractable to the class format chosen. A list of resources to complete the course and a detailed outline are common results of this narrowing process. By completion of the outline, the student and advisor agree to the scope of work to be performed. The deliverable is always a written paper, but other products may also be required (e.g., website, equipment fabrication, computer programs, analytical results). It is strongly encouraged that all Space Studies students use the services of the UND Writing Center before the paper goes through iterations of editing by the advisor.

Differences
1. SpSt 593 has a variable number of credits while SpSt 997 does not. For SpSt 593, during step 4 of the similarities above, the advisor needs to determine the appropriate number of credits that the class will entail.
2. SpSt 593 can be taken in two modes: as preparation/precursor to SpSt 997 or a thesis or as an independent class that does not have immediate impact on a future SpSt 997 or thesis.
3. SpSt 593 should be focused on a specific topic. One advisor should easily address this focus.
4. SpSt 997 can be as focused as a SpSt 593, but this is not required and may not be advisable for most students. Many of the best 997s are integrative in nature and may have drawn on the advice from more than one advisor (although the 997 has only one “official” advisor).
5. Students pursuing an integrative 997 may want to do one or more 593s. This allows each 593 to focus on a specific topic. The 997 integrates the results of the 593s and/or explores the interactions between the 593s.
6. Most students require more than one semester to complete a 997; 593s are usually completed in one semester. If a student-initiated class takes more than one semester to complete and the student has formally enrolled in the class, an “I” (Incomplete) for 593 or “SP” (Satisfactory progress) for 997 will appear on the student’s transcript until that course is completed. Once the course is completed, a regular letter grade will be assigned. If a student wants to avoid an “I” or “SP”, grade, then they can begin their research in one term and not officially sign up for the class until a following term in which they expect to complete the course, or complete the course within one semester.
7. Since SpSt 997 requires paperwork by the student, Department, and School of Graduate Studies, potential additional paperwork is avoided when the student signs up for SpSt 997 in the term they will finish the project; by this term, it is unlikely the student will change their topic, which would require additional paperwork.

Grade Expectations
The following expectations for specific grades are general guidelines only. These expectations primarily apply to SpSt 997. Regardless of whether the student is taking SpSt 593 or 997, the student needs to discuss specific grade expectations with the advisor.

<table>
<thead>
<tr>
<th>Final Grade</th>
<th>Minimum Expectation to Achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Student conducts original research (implies the creation of new knowledge). In the sciences and engineering, this often involves experimental approaches that generate new data. In the humanities and social sciences, this often involves applying existing methods to new topics. The creation of new knowledge often requires thorough literature reviews, novel integration, critical analysis, and independent assessment of this information. These studies may be worthy of a peer-reviewed publication.</td>
</tr>
<tr>
<td>Grade</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>B</td>
<td>Student does not conduct original research, but rather writes a report based primarily upon the work of others that does not create significant new knowledge. These reports often incorporate more than one discipline of space studies. These studies are generally not worthy of a peer-reviewed publication.</td>
</tr>
<tr>
<td>C or lower</td>
<td>Student fails to meet the expectations for higher grades. This often occurs when the report has little additional thought, insights or integration beyond a literature review or the report incorporates only one discipline of space studies.</td>
</tr>
<tr>
<td>F</td>
<td>Student plagiarizes. See academic honesty section below.</td>
</tr>
</tbody>
</table>

**LITERATURE REVIEW GUIDELINES**

A literature review is a required part of course research papers, SpSt 593 and SpSt 997, and thesis work.

**What is a Literature Review?**

The format of a literature review varies from discipline to discipline and from assignment to assignment. A literature review may be a self-contained unit (an end-in-itself) or a rationale for engaging in research. The purpose of a literature review is to critically analyze the relevant, published research through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles.

**Introduction**

Define or identify the general topic, issue, or area of concern, providing an appropriate context for reviewing the literature. Discuss overall trends in what has been published about the topic; or conflicts in theory, methodology, evidence, and conclusions; or gaps in research and scholarship; or a single problem or new perspective of immediate interest. Establish your reason for reviewing the literature; explain the criteria to be used in analyzing and comparing literature and the organization of the review; and state, if applicable, why certain literature is or is not included.

**Body**

Group research studies and other types of literature (reviews, theoretical articles, case studies, etc.) according to common denominators or classifications such as qualitative versus quantitative approaches, conclusions of authors, specific purpose or objective, chronology, etc. Summarize, synthesize, and integrate individual studies and articles with as much or as little detail as each one merits according to its comparative importance in the literature.

**Conclusion**

Summarize major contributions of significant studies and articles to the body of knowledge under review, maintaining the focus established in the introduction. Evaluate the current “state of knowledge” reviewed, pointing out major methodological flaws or gaps in research, inconsistencies in theory and findings, and areas or issues pertinent to future study. Conclude by providing some insight into the relationship between the central topic of the literature review and a larger area of study, such as a discipline or a scientific endeavor.

**GUIDELINES FOR WRITING A GRADUATE LEVEL PAPER**

The students will be frequently required to write papers in the various courses they will take and in the comp exams. Here are some guidelines for writing a graduate level paper.

1. Web sources are **not acceptable** as primary sources of information except where the website is that of a reputable investigator with professional credentials in the field. In that case, the
credentials of the website “owner” need to be appended to the reference. *Remember, any fool can set up a website, and they often do.*

2. Web sources can be used to identify professional papers that have undergone peer review, but in all cases, the original paper must be accessed and used as the source of the material for your discussion. It is not acceptable to use material of the form “the website said that Dr. Doe said --”. You must go to the original paper and see what Dr. Doe actually said.

3. Never cite a paper or source which you have not read yourself!

4. Popular magazines and newspapers are not acceptable sources of information although they can be useful in identifying such sources. The authors of such articles are seldom trained professionals in the specific topic and often fail to critically evaluate the material that they present. The only exception to this rule would be in cases where the topic was coverage of an issue in the popular media.

5. There is seldom any good excuse for not including the seminal papers related to a particular topic. There are many sources of profession peer-reviewed literature. A handy source of space-related science papers is the NASA-Harvard Astrophysics Data System site [http://adsabs.harvard.edu/](http://adsabs.harvard.edu/). Another source of professional meetings and presentations in the areas of astronomy, planetary science, and remote sensing is the Lunar and Planetary Institute (LPI) website. The LPI website provides access to abstracts from a wide variety of meetings in these areas. The websites of many professional societies provide access to the abstracts and (sometimes) full contents of their journals. The UND Library also has electronic subscriptions to a large number of professional journals. In many cases, you can download PDFs of the complete papers. As a registered UND student, you have access to this resource. Contact the UND Library for help if you have trouble getting access. *If you’ve identified a critical source (for example as a title or the abstract of a published paper), but cannot gain electronic or library access to a full-text copy, contact your advisor. He may have access to the source of the paper. But first exhaust your own resources to get a copy.*

6. Use abstracts of presentations at professional meetings with caution. Normally a peer-reviewed paper should follow within a year or so of the date of the meeting presentation. Any older abstract for which no peer-reviewed paper was forthcoming should be treated with caution. Whenever it exists, you should always use the peer-reviewed paper rather than the original abstract.

7. Read and critically evaluate each source that you use. Does it make sense? Are its conclusions supported by the data it presents? Does the author appear to have a prejudice one way or the other? Are disagreements between different investigators significant for the issue at hand?

8. Beware of plagiarism. Plagiarism is a serious violation of the UND code of behavior, which can lead to failing a course and disciplinary action up to and including expulsion from the University. *The approach to writing papers that is commonly allowed – or even taught – in high schools often involves plagiarism.* Since the consequences can be severe even for unintentional plagiarism, it is strongly recommended that you visit and understand the material contained in the following website: [https://www.indiana.edu/~istd/](https://www.indiana.edu/~istd/). To see how UND deals with plagiarism, Appendix IIIa-3 of the Code of Student Life: [http://und.edu/code-of-student-life/](http://und.edu/code-of-student-life/).

9. Do not use footnotes to reference your sources unless you check with the instructor to whom you will be submitting the paper. Most professional publications do not use footnotes. Unless instructed otherwise, references should be given in the body of the text in the following form (Adams, 1974 [single author papers], or Adams and Filice, 1967 [2 author papers] or Formisano *et al.*, 2004 [three or more authors]) and then listed (once) alphabetically in the reference list at the end of the paper in the following form:
References


Formats
*Journal:* Author, Date, Full Title, Journal, Volume, Pages. [See above.]

*Abstract:* Author(s), Date, Full Title, Meeting, Abstract number or Pages in abstract volume. [Example: Mumma M. J., R. E. Novak, M. A. DiSanti, B. P. Bonev, N. Dello Russo (2005) Detection and Mapping of Methane and Water on Mars. 36th DPS Meeting, Abstract #26.02 or 216 [Abstract]]


If you want to cite specific pages, that is done in the citation in the text: Wasson (1974, pp. 100-105).

*Book (edited volume of papers by different authors):* Author(s), Date, Full Title, Book Title, Editor(s), Publisher, Pages. [Example: Bell J. F., Davis D. R., Hartmann W. K. and Gaffey M. J. (1989) Asteroids: The big picture. In *Asteroids II* (eds. R. P. Binzel, T. Gehrels and M. S. Matthews), University of Arizona Press, Tucson, pp. 921-945.]

10. Any web references should be complete and directly accessible. If your material is several subdirectories below the main address, reference the complete address to the subdirectory.

11. Take care with your writing. Proof your text and try to write as clearly as possible. Use the spell checking option on your word processor. It is recommended that you get a copy of *Elements of Style* by Strunk and White and read it. (*Copies are cheap and readily available in new and used bookstores and on the web.*) It is an excellent handbook to improve your writing skills. Good writing skills will serve you well in any career that you choose to follow.

**THESIS OPTION – THINGS TO REMEMBER**
The paperwork that you must submit before graduation includes:

1. Advisor or Committee Appointment Request.
2. Program of Study.
3. Thesis Topic Proposal Form (SpSt 593 can be used to develop thesis proposal).
6. Application to Graduate.

These forms are online (along with advisor and committee change forms, if required) at the [http://www.space.edu/Space_edu/OnlineForms.aspx](http://www.space.edu/Space_edu/OnlineForms.aspx) and at the UND School of Graduate Studies.
The School of Graduate Studies will not let someone graduate whose paperwork is late. Also, see the Thesis / Dissertation submission guide available at http://graduateschool.und.edu/current-students/electronic-submission.cfm. You will also find the Graduate Student Handbook: Master’s Degree, at http://graduateschool.und.edu/current-students/resources.cfm. This is very helpful for completion of the forms process. Finally, please refer to the student progress checklist at the One-Stop Student Services webpage for the suggested timelines and necessary forms. Access the Space.Edu student progress checklist at http://space.edu/Academic%20Programs/Onestop.aspx under “forms”.

Thesis Expectations
The expectation with the thesis is that the student conducts original research. This implies the creation of new knowledge. In the sciences and engineering, this often involves experimental approaches that generate new data. In the humanities and social sciences, this often involves applying existing methods to new topics. The creation of new knowledge often requires thorough literature reviews, novel integration, critical analysis, and independent assessment of this information. Further, the thesis must meet the disciplinary standards, which are set by the thesis committee, out of which the student is working. Thesis work is usually worthy of a peer-reviewed publication, and so, as part of the thesis requirements, the student must submit the thesis, or an article derived therefrom, to a peer-reviewed publication. Which journal or publication is used will be agreed upon by the student and the advisor. Acceptance of the paper by the chosen journal or publication is not required for completion of the Space Studies degree.

Please note that past student research titles for theses are available online at http://space.edu/ResearchandFacilities/StudentResearch.aspx. Also, you may review the collection of prior theses in the Departmental office; which may provide you with additional ideas for topics and presentation styles.

Faculty Advisory Committee
The Faculty Advisory Committee (i.e., thesis committee) consists of three members of the UND Graduate Faculty. Your Space Studies faculty advisor serves as the committee chair. You and your advisor need to select two other graduate faculty members from UND to serve on your committee. At least one of these members must be from a UND academic department external to Space Studies. If your program of study includes a minor or cognate, one of the committee members must be from that respective department. In some cases, a fourth, non-UND committee member can be included. The student’s Space Studies faculty advisor, the Director of Graduate Studies, and the School of Graduate Studies must approve all thesis committee members.

Program of Study
By the completion of 15 credit hours for the Thesis Option, you must officially inform the Department and the University which courses you will use to satisfy all academic requirements for earning the Space Studies Master of Science Degree. This is accomplished through the Program of Study. Guidelines for filing this document are provided in the previous section regarding the non-thesis option. Note that the program of study for the thesis option needs to be signed by your thesis faculty advisory committee. A requirement for the thesis option is that you register for SpSt 593 with the consent of your advisor. SpSt 593 is used to develop the research proposal for the thesis.
**Topic Proposal Form (SpSt 998)**
Your advisor must approve the topic for the SpSt 998 Thesis. This is accomplished when you complete the form entitled “Topic Proposal Form” and submit the outline to your advisor for approval. This form can be found at [http://www.space.edu/Space_edu/OnlineForms.aspx](http://www.space.edu/Space_edu/OnlineForms.aspx) and must be approved by your committee. The Department and School of Graduate Studies must have this completed form on file for students in the thesis track to graduate.

**Proposal and Defense Expectations**
Prior to writing the thesis, yet subsequent to the Topic Proposal Form paperwork, the student must propose the topic to their thesis committee and Space Studies faculty. Typically, this process involves the student delivering an oral presentation approximately forty to forty-five minutes in length, often accompanied by a PowerPoint or other kind of visual representation of the proposed research. The student should discuss the particular points for discussion with his or her advisor, but in general the student will demonstrate what thesis question is being pursued, why the topic was chosen, the methods planned for engaging in the research, the kinds of literature that will likely be reviewed, what experiments (if any) are planned, and what the student expects to find once the research is completed. During the presentation, members of the public are permitted to view your proposal. At the completion of the presentation, faculty members and members of the public are invited to ask questions about the topic, to which the student should be prepared to proffer answers. Once this “public” phase of questions is completed, the student’s thesis committee will remain behind in a private session to continue asking questions. All told, the process normally consumes around one hour. It is important to remember that the Thesis Proposal cannot occur in the same semester as the Thesis Defense, so the student should plan accordingly.

Upon completion of the student’s research and writing, he or she will conduct a Thesis Defense, which represents the culmination of the student’s efforts. As with the Proposal, the student will conduct an oral presentation which lasts around forty to forty-five minutes, after which there will be questions posed by members of the public and the faculty. The contents of the presentation will be a product of a discussion held with the student’s advisor, but will typically include what thesis question was pursued, why the topic was chosen, the methodology engaged in conducting the research, the kind and extent of literature reviewed, what experiments (if any) were conducted, and what the student concluded based on the completion of the research. Following the “public” Q&A session, you will be asked further questions by the Thesis Committee in a private session. This will also be a time where the Thesis Committee can ask the student questions on the scope and quality of the written thesis document. If the committee approves of the work, they will sign their approval at the conclusion of their questions.

**School of Graduate Studies Guidelines for the Thesis**
Your thesis must be prepared according to the Instructions for the Preparation of Theses and Dissertations to be accepted by the Faculty Advisory Committee and Dean of the School of Graduate Studies in partial fulfillment of the requirement for Masters of Science in Space Studies. These instructions take precedence in all matters of format, but students and their advisors are urged to refer to one of the leading style guides, such as Turabian’s *A Manual for Writers of Term Papers, Theses, and Dissertations, 8th Edition*, or to the style of a leading journal or other publication in the discipline, for guidance in those aspects left to their discretion. The School of Graduate Studies staff also may be consulted for advice.

The student is responsible for the preparation of the thesis according to the format prescribed by these instructions and by the faculty advisory committee, and within the timetable specified by the School of
Graduate Studies. For more specific information, consult the School of Graduate Studies website and your advisor. A format checklist is available at there that can be helpful to ensure you meet all formatting requirements. Go to http://graduateschool.und.edu/current-students/electronic-submission.cfm.

The student and advisory committee jointly are responsible for the scholarly style and usage in the thesis. In fulfillment of this responsibility, each member of a candidate’s advisory committee must review and approve a preliminary draft of the thesis. The committee’s approval is verified by filing a Preliminary Approval of Thesis to the School of Graduate Studies. This signed approval is a contract with the student and a commitment that the members of the advisory committee will require no major changes of the content, organization, or style after the final copy has been prepared. It is strongly recommended to submit a copy of your thesis for a format check prior to the deadline for submission. A list of reviewers for hire can be obtained from the School of Graduate Studies. The final copy is approved by the members of the advisory committee after a successful defense and then submitted to the School of Graduate Studies for the graduate Dean’s approval.

The student should submit the preliminary draft of the thesis to the advisory committee at least eight weeks prior to graduation. The Preliminary Approval form will be sent to the Committee Chairperson about six weeks prior to graduation if the student has submitted the Application for a Graduate Degree form to the School of Graduate Studies by the published deadline and if the student is eligible for graduation.

The student must file the “preliminary approval of theses and dissertations” form in the School of Graduate Studies no later than the deadline specified in the academic calendar. The preliminary approval deadline is absolute (i.e., if the deadline is not met, the student will not be among the degree recipients for that semester and will not participate in commencement).

The final copy of the thesis must be approved by the advisory committee and electronically submitted to ProQuest for the approval of the Dean no later than the date specified in the academic calendar, usually two weeks before graduation. Once you electronically submit your final copy for publishing, no changes can be made to the format or content.

Go to the School of Graduate Studies website for guides, checklists, and online assistance as you prepare your final thesis document. These helpful guides are found at http://graduateschool.und.edu/current-students/electronic-submission.cfm

**Thesis Printing**

The Department of Space Studies requires a printed, bound copy of your final thesis/dissertation. In most instances, each of your committee members may also want a bound copy. This may be done rather inexpensively through the Chester Fritz Library on the UND Campus, at a cost of $25 per copy. To order, you may stop by the Periodicals desk to pick up an order form, or contact Randy Rasmussen by email (randy.rasmussen@und.edu) or call him direct at (701) 777-3316. You must provide the library with the printed pages ready for binding. A source for inexpensive printing is the UND Duplicating Department or a local copy shop.

When you submit your final thesis to Pro-Quest as the official graduate school record, you are required to order one printed copy that will be the property of the Chester Fritz Library, at an approximate cost
of $40. You may order additional copies, but note that it may be less expensive to have the extra copies made at the Chester Fritz Library or a local print shop.

Please note, the department administrative assistant also needs an electronic copy of your thesis/dissertation for departmental records.

NON-THESIS OPTION - THINGS TO REMEMBER
The paperwork that you must submit before graduation includes:
1. Advisor or Committee Appointment Request.
2. Program of Study.
3. Topic Proposal Form.
4. Application to Graduate.

These forms are online (along with advisor change forms if required) at http://www.space.edu/Space_edu/OnlineForms.aspx and on the UND School of Graduate Studies website. Please watch the School of Graduate Studies website for the dates when these forms are due. The School of Graduate Studies will not let someone graduate whose paperwork is late. Finally, please refer to the student progress checklist at the One-Stop webpage for the suggested timelines and necessary forms.

Program of Study
By the completion of 15 credit hours, you must officially inform the Department and the University which courses you will use to satisfy all academic requirements for earning the Space Studies Master of Science Degree. Please do not fill in the grades as the School of Graduate Studies accomplishes that. Additionally, the Program of Study must have the student’s original signature on it. Online students will have to mail, fax or e-mail this form to the Department. The Department and School of Graduate Studies must have this form on file for students to graduate.

Topic Proposal Form (SpSt 997)
Your advisor must approve the topic for the SpSt 997 Independent Study. This is accomplished when you complete the form entitled “Topic Proposal Form” and submit the outline to your advisor for approval. This form can be found at http://www.space.edu/Space_edu/OnlineForms.aspx and should be sent to your advisor. The Department and School of Graduate Studies must have this completed form on file for students in the non-thesis track to graduate.

Independent Study Report (SpSt 997)
Students typically enroll in the SpSt 997 course during their final semester. The general requirement for a Space Studies 997 is that you complete a significant research report on any aspect of space activities. Your advisor will determine the specific expectations for the 997. Once you and your advisor are satisfied with the 997 report, you MUST submit two (2) bound copies of your report, one to your advisor and one to the Department of Space Studies administrative assistant. You must also submit an electronic copy of your final report to the administrative assistant for a permanent department record. We also recommend that you make a third copy for yourself to keep. If you have questions on what is expected of you to complete a 997, you may review the collection of prior 997 papers in the Departmental office. Reviewing them may provide you with additional ideas for topics and presentation styles. Past student research titles for thesis and independent study reports are available online at
TRANSFER CREDITS
The UND School of Graduate Studies has specific policies for transfer of credits. Refer to the Academic Catalog (http://und.edu/academics/Registrar/catalog-current.cfm) for a description of these policies. Based on these guidelines, the Department of Space Studies recommends to the School of Graduate Studies the transferable courses. The School of Graduate Studies then decides which of those courses can be transferred. Typically, students apply for credit transfers after accepting admission to the program by submitting an official program of study. Furthermore, students must be on “approved” status (ref. Admission Status section) to be granted transfer credit. Please refer to the department’s transfer credit guidelines posted at the Space.edu One-stop page under policies and handbooks at http://space.edu/academic-programs/one-stop.aspx.

COMPREHENSIVE EXAMINATION
The Space Studies Master’s program introduces you to the breadth of Space Studies and the linkages between the different disciplinary areas: history, policy, law, management and economics, engineering and technology, and science. You then build on the content, approach, and methodologies of the different disciplines in your courses. The goal is to develop core knowledge and both interdisciplinary and multidisciplinary understanding and thought processes. On this basis, the primary goals of the comprehensive exam process are to assess your ability to integrate information across the various courses and disciplines that are part of the Space Studies MS degree program and to demonstrate mastery of core concepts key to a Space Studies education.

The comprehensive exam process comprises three separate stages that, upon completion of your education, should demonstrate your core knowledge and integrative skills. Stages 1 and 2 are conducted at the end of your 501 and 502 courses, respectively. They will serve to test your core knowledge of space studies subjects and will be based on a mixture of multiple choice/short answer questions, as well as longer essay questions. If a student fails the first attempt at stage 1 or 2, he or she will be given the option to repeat the exam within a month. All masters students, both on thesis and non-thesis track, will be required to take comprehensive exams 1 and 2, while only the students on the non-thesis track are required to take comprehensive exam 3.

Comprehensive exam 3 will not test you on the specific content of any particular course; rather, the exam requires you to apply the principles and methodologies, and your understanding of the interplay between different, often competing, forces (e.g., foreign policy vs. science). In other words, demonstrating your knowledge of individual courses is not sufficient. To pass, you must show how the information from these courses can be used to assess and analyze a broadly cross-disciplinary issue. The expectation is that graduating students should be able to provide a broad-based, integrated, and analytical response on any major space related initiative.

Comprehensive exams will be scheduled during both the fall and spring semesters (typically October and April). E-mails will be sent out to students in advance of each of these exam dates which will contain important information on topics, grading criteria and procedures, and chat sessions designed to help in preparations. Prior to taking Stage 3 of the comprehensive exam, the student must have completed at least 24 semester credits, including all technical area and policy area requirements, before the semester in which the comprehensive examination is taken. The Department will distribute between two and four possible exam topics prior to the comprehensive exam, allowing students to prepare ahead of time.
of time. One of these topics will then be the comprehensive exam question. The faculty collectively grades the exams. Students receive either a passing grade or a failing grade. If the student fails, they will be allowed to retake the exam as the next scheduled offering. No more than three (3) failures will be allowed. A student gets three tries. That means he or she can fail twice but then must pass on the third try. If the student fails three times, they are no longer eligible to complete the degree. If the student desires an additional try, they must petition the Department outlining a clear plan for succeeding on a fourth try.

Under a newly initiated policy, a student – after failing the exam at least twice – may request the option of taking the alternate comprehensive examination. To implement this option, the student should contact their advisor after reviewing the alternate comprehensive examination documents posted at the One-Stop Student Services webpage under the Policies and Handbooks section located at http://space.edu/Academic%20Programs/Onestop.aspx.

Examination Strategies
The comprehensive exam will require you to analyze a broad historical and/or current space issue, system, or program. To do so, we will require you to use at minimum one technical discipline area (physical or life science, technology/engineering), one non-technical discipline area (policy/law, economics/management, history), and one discipline area of your choice beyond the original two selected (any of the 6 disciplines noted). Your job is to show the interconnections between these three selected areas for the given project, system, or issue. Example topics have included and could include in the future: Space Shuttle; space stations; Earth observations; Mars exploration; satellite navigation systems; satellite communication systems; Apollo; International Space Station; reusable launchers; expendable launchers; and space commerce and privatization.

You will have only about 120 minutes for the exam, so it will be impossible for you to answer with all the material you need in the 120 minutes. You must prepare well ahead of time. It is acceptable for you to “pre-write” answers on potential topics. If you do this, then you must edit and tailor this to specifically meet the question asked. Unedited answers that show you did not take into account the specifics of the question (with a lot of unrelated materials, for example) will be cause for failure.

Using Apollo as an example to illustrate the kinds of interactions expected for analysis and explanation:

Politics and Technology: The design of Apollo was clearly driven by political goals. The political challenge was to put a man on the Moon by the year 1969, prior to the Soviet Union. The deadline of 1969 essentially overruled the Earth Orbit Rendezvous and Direct Ascent approaches. Direct Ascent required the creation of a massive Nova rocket, the development and testing of which could not have been completed. EOR was more plausible, but its main intent was a “stepwise” development plan from Earth orbiting rendezvous and space station capabilities prior to the lunar landing. Again, time precluded such a logical “stepwise” approach to the riskier LOR design. The end result was a “dead-end” program that did not lead to earth-orbiting capabilities or to technologies that might be useful for other purposes.

Economics (and politics) and Technology: Contrary to popular belief, NASA did not receive a blank check. By 1962 and 1963, cost overruns were threatening Congressional support. D. Brainerd Holmes tried to get more money out of NASA Administrator Webb by gutting other NASA programs or going to get a Congressional supplemental appropriation, but failed. Webb would not risk it. He then tried to go directly to Kennedy to get more funding. Kennedy was sympathetic but
ultimately backed Webb, his chosen administrator. George Mueller, who had to find a way to meet Kennedy’s goals within a reasonable budget, replaced Holmes. This drove the importation of Air Force management reforms, and the “all up” testing philosophy. The all up philosophy was riskier, but succeeded. Air Force methods imposed stricter executive control, and strict communication and coordination techniques. Cost estimates leveled out, and Congressional support remained sufficient. Both EOR and DA methods for going to the Moon were ruled out based on cost considerations as well as politics. The last few missions were cancelled because of the very high cost, and also because political support evaporated quickly once the US beat the Soviets to the Moon.

Physical Science and Politics: Apollo was primarily a political program, but it made possible good science. Some robotic missions were diverted from their original goals to support Apollo, like Ranger and Surveyor, and others such as Lunar Orbiter were created explicitly for Apollo, for site selection in this case. Apollo tinkering with Ranger nearly caused the failure of that program, and other scientific goals were eliminated to ensure that Apollo goals predominated, such as showing that the lunar surface could hold the weight of the Lunar Module and the astronauts. However, it was tough going to get Apollo’s engineering managers to incorporate science into the actual missions. Scientists did eventually convince the managers that there should be some scientific objectives, although for the early missions these were minimal. Astronauts received geological training for the later missions, and the site selections for these missions were significantly influenced by scientific criteria. The results of Apollo were a goldmine for lunar geologists and astronomers, but the lack of any scientific missions beyond Apollo for the next three decades show how little science had to do with Apollo. Each mission was a political risk (failure), and after a few missions, the political risks outweighed any scientific benefits. The scientific results verified a “hot Moon” theory of lunar origins, the impact origins of most if not all craters, and the likely origin of the Moon as part of a huge impact of a large body with the Earth.

There are undoubtedly more “interactions” among the various space studies discipline areas for the Apollo program than those noted here. However, these examples give you some idea about the sort of thing we are after. If you do not show connections between disciplines, you will not pass.

Please also see section on guidelines for writing a graduate level paper.

OTHER EXPECTATIONS AND REQUIREMENTS
To earn a Master’s Degree in Space Studies, you must satisfy requirements from the Department and the School of Graduate Studies. The admission status and courses have been listed above, but keep in mind there are other requirements noted in the UND Academic Catalog for which you are responsible. We have collected the majority of them here for your convenience, but remember that you, the student, not the University, nor the Department, nor your advisor, are responsible for meeting all the requirements and deadlines.

Advisor
All incoming students are assigned a temporary faculty advisor. The temporary advisor will help you with initial academic counseling and in identifying an appropriate permanent faculty advisor for your academic and research interests.

Students are urged to choose a permanent advisor as quickly as possible, but not later than by the end of the second semester in the program. Once you have chosen an advisor and that faculty member has agreed to be your advisor, complete the New Committee or Change to Advisor or Committee form.
found at [http://www.space.edu/Space_edu/OnlineForms.aspx](http://www.space.edu/Space_edu/OnlineForms.aspx). This form must be submitted to your advisor for signatures and will be sent to the School of Graduate Studies. You may change your advisor if your interests change. If your advisor selection remains your assigned temporary advisor, this form is not required.

**Maximum and Minimum Academic Loads**
A full course load for a (campus) graduate student is 9 credit hours in a semester or 6 credits in a summer session. A graduate student may carry no more than 12 credit hours per semester or 12 credits in a summer session. Graduate Assistants must carry at least 6 credits each semester or 3 credits in a summer session. The department recommends that online students take no more than 6 credit hours per semester if they work full time, and no more than 3 credit hours during the summer semester since the summer schedule is compressed. All courses should be part of a student’s defined Program of Study.

**Grading**
The credit for a course is allowed only when a grade for the course has been reported to the UND Registrar’s Office. Grades awarded are indicative of work quality in all courses. UND grades are as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Outstanding graduate level performance</td>
</tr>
<tr>
<td>B</td>
<td>Good/Acceptable graduate level performance</td>
</tr>
<tr>
<td>C</td>
<td>Non-acceptable graduate level performance</td>
</tr>
<tr>
<td>D</td>
<td>Failed graduate level performance (no graduate credit awarded)</td>
</tr>
<tr>
<td>F</td>
<td>Failure</td>
</tr>
<tr>
<td>Au</td>
<td>Audit</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>W</td>
<td>Withdrawn</td>
</tr>
<tr>
<td>SP</td>
<td>Satisfactory Progress (995, 997, 998, and 999)</td>
</tr>
<tr>
<td>UP</td>
<td>Unsatisfactory Progress (995, 997, 998, and 999)</td>
</tr>
</tbody>
</table>

A graduate student’s cumulative GPA is based upon all coursework, graduate and undergraduate, taken while the student is registered at the UND School of Graduate Studies. Grades of less than "C" are not included in the number of semester credits required for a degree, but they are counted in determining the cumulative GPA. Grades of Incomplete are neither counted in semester credits nor in cumulative GPA.

All graduate students must maintain a cumulative GPA of 3.0 for all coursework completed. Failure to maintain this 3.0 GPA will result in academic probation by the School of Graduate Studies. The student will have one semester on academic probation to improve the cumulative GPA to the required minimum GPA of 3.0. A failure to accomplish this will result in the academic dismissal from the program of space studies.

**Incomplete Grades**
It is expected that students will complete all requirements for a course during the time frame of the course. For reasons beyond a student’s control, and upon request by the student or on behalf of the student, an incomplete grade may be assigned by the instructor when there is reasonable certainty the student will successfully complete the course without retaking it. The mark “I,” Incomplete, will be
assigned only to the student who has been in attendance and has done satisfactory work up to a time within four weeks of the close of the semester, including the examination period, and whose work is incomplete for reasons satisfactory to his or her instructor. Incompletes are entered on the final grade sheet, and instructors must also sign and submit a “Report of Incomplete Grade” form to the Office of the Registrar. The instructor may choose any one of the following options for the deadline to complete the course:

1. The default date as stated in the “UND Schedule of Courses.”
2. Extend to 12 calendar months after the end of the course.
3. A date of the instructor’s choosing no later than 12 months after the end of the course.

Incomplete grades will convert to a grade of “F” if a grade is not submitted by the instructor to the Office of the Registrar on or before the deadline written on the “Report of Incomplete Grade” form.

The instructor of the course and the Dean of the School of Graduate Studies must approve and sign the “Report of Incomplete Grade” form for any extension of incomplete beyond the default date listed in the “UND Schedule of Courses.” It is the student’s responsibility to contact their instructor about an incomplete grade posted on the final grade report.

An “I” may be converted as indicated above but cannot be expunged from the record. Students may not register for courses in which they currently hold grades of incomplete, except for courses that allow repeated enrollment. A student will not be allowed to graduate with an unconverted incomplete grade on the academic record.

Course Repetition
All courses taken by graduate students, for which a grade of D, F, or U was received, may be repeated once for credit, with only the second grade to count in the grade point average. This option does not apply to a student who has been dismissed. Courses with grades of C or better may not be repeated without written approval of the School of Graduate Studies. It is up to the student to notify the School of Graduate Studies when a course has been retaken so that the grade point average can be recalculated. Courses taken as an undergraduate may not be taken again as a graduate student and used in a program of study.

Maximum Period Allowed for Graduate Programs
Graduate courses more than 7 years old are considered obsolete and may not be counted to fulfill course requirements for an advanced degree program. These courses may be revalidated and counted toward an advanced degree on the recommendation of the student’s chair and advisor and with the consent of the School of Graduate Studies. In no case will more than one-half a program be accepted for revalidation. Revalidation of such courses can be approved only with a demonstration that the student’s knowledge of the course material is current. An oral and/or written examination on the subject matter is required. Approval of the School of Graduate Studies is required prior to revalidation of courses. Students who wish to revalidate courses must consult with the instructor of the course to submit the required paperwork.

ACADEMIC HONESTY
Students are expected to display academic honesty as defined in the University of North Dakota (UND) CODE OF STUDENT LIFE (CODE) found at http://und.edu/code-of-student-life/. The policies contained therein and the addendum below are in force for all students who take a course within the Department of Space Studies.
Plagiarism is a serious academic and professional issue. Many students think that cheating is only copying another student’s work or answers on an exam. Few students seem to understand that using an author’s words or ideas without giving appropriate credit through referencing is also cheating. When you write a paper or take an exam for a Space Studies class, remember not to simply transcribe another author’s words or ideas from a book or journal or the Internet by such methods as “cutting and pasting.” This is plagiarism, the most common type of cheating. Besides signaling a failure to do your own assimilation, thinking, and expression, plagiarism is legally unacceptable. Please see section above on “guidelines for writing a graduate level paper” to understand what constitutes plagiarism. If you have questions about whether or not an item should be referenced, please ask a member of the faculty for guidance. Plagiarism will not be tolerated. The Space Studies Faculty strongly recommend that you familiarize yourself with this subject in the CODE on the UND website.

UND provides two avenues for faculty members who discover student cheating: disciplinary and academic. As a disciplinary action, a case may be forwarded for investigation to the Dean of Students. Disciplinary sanctions for plagiarism may include penalties such as permanent suspension from UND. As an academic action, the faculty member may award a grade of “F” for the paper, test, or even the course. Where repeated academic dishonesty is noticed, the department reserves the right to recommend to the graduate school the dismissal of the student from the program.

GRIEVANCE
A Space Studies student who is not satisfied with a grade, or has any other form of complaint, has the right to file a written grievance, indicating with specificity the issues upon which the grievance is based and to present his/her case to the Space Studies Department Chair. The student must first attempt to resolve the dispute with the concerned faculty member within one hundred and twenty (120) days of the notification of the grade. The faculty member will respond to the complaint within thirty (30) days of receipt of the dispute. If a resolution between the faculty member and the student is not reached, the student may file, within another thirty (30) days, a formal complaint to the Chair* of the department. Upon receipt of the complaint, the Chair of the Space Studies Department will set up a departmental committee consisting of three faculty members (excluding the chair and the faculty member against whom the grievance is filed) to review the complaint and provide a recommendation to the Chair. The Chair will notify the student of his/her decision within thirty (30) days of receipt of the grievance. The student has the right to formally withdraw the complaint at any time during the process. It may be noted that handling of grievances during spring, summer and winter breaks will depend on the availability of faculty members and the days when the faculty members are not available during such breaks will not count towards the response times mentioned above. If the student is not satisfied with the decision of the Chair, he/she may grieve the Chair’s decision at the college level pursuant to the John D. Odegard School of Aerospace Sciences’ grievance procedure.

*If the Chair of the Space Studies department has issued the grade or has the complaint filed against him/her, the student is to take the grievance to the college level immediately after trying to resolve it with the concerned faculty member who is the Chair.

OFFICIAL TRANSCRIPTS AND ACCESS TO GRADES
The University of North Dakota has authorized the National Student Clearinghouse to provide official transcript ordering via the web. The details can be found at http://www.und.nodak.edu/dept/registrar/trans/requestonline.htm. Your grades, tuition account balance, and class schedule information can be accessed online at Campus Connection: http://www.und.edu/dept/registrar/campusconnection/index.htm.
APPLICATION FOR GRADUATION
At the beginning of the semester in which the student wishes to graduate, he/she must apply for graduation. Check the Space Studies or School of Graduate Studies calendar to see when this is due. This form can be found at http://www.space.edu/Space_edu/OnlineForms.aspx and is submitted electronically at the beginning of the semester in which the student wishes to graduate.

GRADUATION
UND holds graduation ceremonies at the end of every semester (fall, spring, and summer) and all Space Studies candidates for graduation are invited to participate in this formal and significant ceremony. Graduation details are posted every semester at http://und.edu/student-affairs/commencement/. Diplomas and final transcripts are sent out to students about 4-6 weeks after commencement. They are mailed to the address a student has listed as a home address in Campus Connection. Please make sure you have the correct address listed. Your diploma will simply state “Master of Science” as the earned degree, and will not indicate the program as “Space Studies”. This is typical across programs at UND.

GRADUATE MINOR AND COGNATES
The Department of Space Studies allows minors and cognates with the proviso that these courses of study are defined in the student’s Program of Study. Minors and cognates are currently unavailable for students taking the online degree program because of the lack of sufficient and relevant graduate online courses from other UND departments.

A minor is a 9-credit program of study at the graduate level in another department outside of Space Studies. The minor must be titled and identified on your Program of Study and be approved by a graduate faculty member of the minor department. Only courses approved for graduate credit are eligible for a minor. A minor is identified on your transcript and diploma. Previous Space Studies students have earned minors in business, geography, geology, mathematics, and political science.

A cognate is a 9-credit program in a department other than Space Studies. All UND courses listed in the UND School of Graduate Studies Catalog are eligible for a cognate, but the Department of Space Studies must approve the selections. A cognate is not identified on your transcript. Few Space Studies students have taken cognates because frequently they only want to take one specific course outside the Department rather than the required three.

Students from other Masters programs seeking a minor in Space Studies must take three space studies courses for nine semester hours of credit. The Space Studies department will work with those doctoral students whose departments require additional credits for a minor degree.

LEAVE OF ABSENCE FROM THE DEGREE PROGRAM
Students who wish to take a leave of absence from their studies must notify their graduate program and the School of Graduate Studies by requesting a leave of absence, which is done by completing and submitting the “Graduate Readmission or Leave of Absence” form to the School of Graduate Studies. The form must be submitted in advance of the leave. Degree and certificate seeking students who do not submit a leave of absence will be required to apply for readmission to the School of Graduate Studies. Applications for readmission will be reviewed by the program and Graduate Dean. Students may be denied readmission based on a review of their prior progress and their application for readmission.

Non-degree seeking graduate students also need to submit a leave of absence or a readmission application if there is a break in enrollment.
The “Graduate Readmission or Leave of Absence” form can be found on the School of Graduate Studies website via a link from the Space.edu one-stop page found at http://space.edu/academic-programs/onestop.aspx. This form requires department approval, so it should be sent to the administrative assistant for processing. If you have questions, please contact the School of Graduate Studies at (701) 777-2784.

GRADUATE ASSISTANTSHIPS
Each year Graduate Research Assistants (GRA) and Graduate Teaching Assistants (GTA), are appointed to assist with the education and research goals of the Department. The students must be on qualified or approved status to be eligible for assistantships. Selection of these appointees is competitive and is made on the basis of academic excellence, promise as a graduate student and the student’s ability to help the department. The General Graduate Record Examination (GRE) must be taken if a student wishes to be considered for funding. Students interested in obtaining an assistantship must contact the Chair of the Department or their faculty advisor before the deadlines for application. Note that only full-time campus students are eligible for assistantships.

GRA and GTA funds come from a variety of sources including the NASA Space Grant, Departmental funds, the UND School of Graduate Studies, and individual advisor grants and contracts. Graduate assistantships include a stipend and a tuition waiver. Assistants are required to work 20 hours each week for a ½ time position and 8-10 hours each week for a ¼ time position under the guidance of a Space Studies faculty member. The work expected for GRAs and GTAs is arranged between the advisor and the student but is typical to help the advisor in research or teaching. Work goals and expectations will be arranged with the advisor and progress will be monitored continuously. Half time and quarter time assistants must carry a minimum of six credits per semester (3 credits for summer). Funded students will be assessed at the end of each academic semester for continued funding. Typically, a maximum of 2 years funding (4 semesters) is available for students.

GRAs, GTAs, and tuition waivers are available to students that are making good progress in their Program of Study. Courses making up deficiencies are not part of a Program of Study.

TUITION WAIVER POLICY
Several tuition waivers are available to Space Studies graduate students who are on approved or qualified status, on a per-semester basis. The following conditions apply for granting tuition waiver:
1) The General Graduate Record Examination (GRE) must be taken if a student wishes to be considered,
2) Tuition waivers will not be available for courses taken to fulfill admission requirements, 3) Courses eligible for tuition waivers must be part of an approved Program of Study, except during the student’s first semester in the program, 4) Waivers will not be granted beyond the limit of 24 credits unless an approved program of study is on file with the School of Graduate Studies, 5) Tuition waivers will not be available for courses taken beyond the required number of credits to graduate, 6) Tuition waivers are not available for students on combined degree program, 7) To be eligible for tuition waivers, the students must maintain a GPA of 3.0 or above, and 8) Tuition waivers will not be available for retaking failed courses, dropped courses for which a waiver was once given, and in lieu of unused waivers. Given the limited resources available, campus student waiver requests are reviewed with higher priority than those from online students. Additionally, UND is currently in the process of revising tuition waiver policies, and it is possible some changes to this policy could occur without notice. Students interested in obtaining a tuition waiver must submit an application form to Bev Fetter. The tuition waiver request form can be found at http://space.edu/Academic%20Programs/Onestop.aspx.
Ranking for allocation of tuition waivers follows this criteria:

1. Campus students with GRA/GTA.
2. Campus students with no GRA/GTA, but on approved status.
3. Campus students with no GRA/GTA, but on qualified status.
4. Online students with at least 9 credits completed, established need, and an approved POS.

Out-of-state campus students are strongly advised to apply for ND residency on completion of one year in UND. All campus students are only eligible for waivers at ND rates or its equivalent dollar value. For the Academic Year 17-18, tuition waivers are made on the basis of:

- North Dakota & US military: maximum 6 credits
- Minnesota: maximum 6 credits
- Contiguous states (Montana, South Dakota, Manitoba, Saskatchewan): maximum 4 credits
- Non-resident: maximum 3 credits

Tuition waiver applications should be submitted by May 15th. Late applications may be accepted at the discretion of the department. Awards are for a waiver of tuition only. Other mandatory fees are paid by the student.

**EXPECTATIONS OF FUNDED GRADUATE STUDENTS**

1. Required attendance at all departmental seminars, colloquiums, brown bag lunches and other departmental events including student thesis proposal and defense presentations.
2. Hours of work to be completed in the Department, associated office space, or by arrangement with the advisor.
3. Steady progress towards completion of degree.
4. Maintenance of at least a 3.0 GPA.
5. Involvement in outreach activities for the Department.

**OTHER FINANCIAL AID INFORMATION**
The School of Graduate Studies lists financial aid resources at their webpages. Go to [http://graduateschool.und.edu/current-students/financial-assistance/index.cfm](http://graduateschool.und.edu/current-students/financial-assistance/index.cfm). These resources include federal financial aid, School of Graduate Studies’ scholarships and tuition waivers, graduate research assistantships and others.

**SCHOOL OF GRADUATE STUDIES POLICIES AND PROCEDURES**
Students may contact the School of Graduate Studies regarding their specific policies. The School of Graduate Studies can be reached by calling (701) 777-2784 or toll-free 800-CALL-UND ext. 2784. Or you may review their policies at [http://graduateschool.und.edu/current-students/resources.cfm](http://graduateschool.und.edu/current-students/resources.cfm).

**IMPORTANT DATES AND DEADLINES**
Most commonly used calendars are linked at the One-Stop Student Services webpage at [http://space.edu/Academic%20Programs/Onestop.aspx](http://space.edu/Academic%20Programs/Onestop.aspx). Important calendars to be mindful of are the following:

- **Academic Calendar**: [http://und.edu/academics/registrar/calendar-academic.cfm](http://und.edu/academics/registrar/calendar-academic.cfm)
- **Student Account Services**: [http://und.edu/admissions/student-account-services/dates-and-deadlines.cfm](http://und.edu/admissions/student-account-services/dates-and-deadlines.cfm)
- **School of Graduate Studies**: [http://graduateschool.und.edu/events-all.cfm](http://graduateschool.und.edu/events-all.cfm)
STUDENT ORGANIZATIONS AND ACTIVITIES

**Dakota Space Society**
The Dakota Space Society (DSS) advances space science, policy, and exploration by supporting Department of Space Studies graduate students as well as other graduate and undergraduate students with an interest in the space program. Membership in DSS is open to any student at the University of North Dakota and meetings are held in the Department of Space Studies. DSS expands the outreach mission of the North Dakota Space Grant Consortium by publicly promoting space education and space related activities in the University and the community. DSS also sponsors several trips and other social outings to expand knowledge about how the space program is supporting various local industries. Examples of previous trips include the Earth Resources Observation Systems (EROS) Data Center in Sioux Falls, South Dakota, and the Manitoba Remote Sensing Center in Winnipeg, Canada. Additionally, students have traveled to the Lunar and Planetary Conference and the World Space Congress (2002), both in Houston, Texas. The DSS advisor is Dr. Michael Dodge.

**Northern Skies Astronomical Society**
The Northern Skies Astronomical Society promotes astronomy throughout the UND campus and the local community. The club sponsors observation nights for the public and other frequent “star parties” at various local observing sites. This club is open to all UND graduate and undergraduate students; the club conducts monthly meetings.

**American Institute of Aeronautics and Astronautics Student Chapter**
The purpose of the University of North Dakota's AIAA Chapter is to promote the advancement of aeronautics and astronautics and uphold the professionalism in the pursuit of these goals while interacting with other disciplines on space-related activities. The AIAA advisor is Dr. Jim Casler

RESEARCH FACILITIES

**Infrastructure**
Campus graduate students will be provided offices with phone and internet connections in the School of Aerospace Sciences building complex. Also, graduate students will be given copying and laser printing privileges through the Department of Space Studies.

**High Altitude Ballooning Laboratory**
The North Dakota Space Grant Consortium and Department of Space Studies support student-centered high-altitude ballooning activities. These activities are facilitated by the High Altitude Balloon Laboratory which is located in Clifford Hall, Room 370. This laboratory is used to design, construct, test, and store high-altitude ballooning hardware such as payloads, balloons, tracking gear, and balloon filling equipment. This facility is equipped with computer stations and work benches, and is available to Space Studies students for near-space mission, hardware, and software development.

**Space Studies Observatory**
The Department of Space Studies operates The Department of Space Studies operates an astronomical observatory located on UND land in Oakville Prairie, which is located about 10 miles west of Grand Forks. The site includes three Internet-controllable Schmidt Cassegrain Telescopes that can be used on-site or remotely via ACP Observatory Control Software. Institutional programs include asteroid and variable star light curve studies, and a solar H-alpha monitoring campaign. These programs allow students to conduct M.S. thesis and non-thesis (SpSt 997) research projects and, if interested, to learn
how to operate a remote observatory by volunteering to work at the site. Students interested in using the observatory are strongly encouraged to take SpSt 425: Observational Astronomy, SpSt 526: Astronomical and Spacecraft Instrumentation, and/or SpSt 528: Space Environment and the Sun. Contact Dr. Sherry Fieber-Beyer at sfieber@space.edu for more information.

**Space Life Sciences Laboratory** *(temporarily out of service)*
The Space Life Sciences Laboratory is managed by the Department of Space Studies and may provide capabilities for research and education in the following areas:

- Physics (physical chemistry) of heat and mass exchange under altered pressure.
- Environmental control under unusual conditions (low pressure and altered atmospheric compositions).
- Low-pressure plant physiology (plant photosynthesis and transpiration in altered environments).
- Closed material cycles stability limits.
- Human factors in control of altered environments.
- High altitude free fall challenges and considerations (theoretical modeling).

The Department of Space Studies has collaborated with the following UND departments in support of these research efforts: Biology, Chemistry, Mechanical Engineering, School of Medicine, the School of Communication, and potentially other departments.

**Spacecraft Simulator Facility**
The Spacecraft Simulator Facility is an aerospace training center with both a vertical launch simulator and a horizontal launch simulator. The simulators can be used by students who enroll in an appropriate Space Studies course.

**Human Spaceflight Laboratory**
The Space Suit Laboratory is part the Department of Space Studies at the University of North Dakota. To visit the laboratory home page please see [http://www.human.space.edu/](http://www.human.space.edu/).

The Mission of the UND Space Suit Laboratory is to:

- To develop state of-the-art space suit components and Extra-Vehicular Activities (EVA) technologies for the space explorers of the 21st Century.
- To collaborate with NASA on the development of space suits, related systems and support the agency’s Vision for Space Exploration (VSE).
- To cooperate with industry to assist in the development of new generation space suits for private spaceflight.
- To be part of educating the next generation of space engineers and space explorers in human spaceflight, human factors, and space suit design, construction and operations.

**North Dakota Planetary Exploration Initiative**
In early 2009, a team formed in the Department of Space Studies was awarded a three-year NASA grant to develop, design, construct, and test advanced inflatable habitat architecture concepts that could be adapted for use on the surfaces of the Moon and Mars. The North Dakota Planetary Exploration Initiative consists of an Inflatable Lunar/Mars Analog Habitat (ILMAH), Pressurized Electric Rover (PER), and analog spacesuits connected externally to the rover via suitports. All three main elements are connected, thereby, allowing the inhabitants of the ILMAH to move into and out of the rover without having to venture “outside.”
The Inflatable Lunar/Mars Analog Habitat can house a crew of four people for up to thirty days. In 2015 NASA awarded a new grant to the department for the addition of four new modules to connect with the existing Inflatable Lunar/Mars Analog Habitat (ILMAH) core module. These modules include a Plant Production Module, EVA and Maintenance Module, Geology Research Module, and an Exercise and Human Performance Module. These additions greatly increase the space of the ILMAH and allow for scientific innovation and fidelity in the analog missions performed by the Human Spaceflight Laboratory.

**Space Studies Reference Collection**
The Department of Space Studies maintains a small collection of journals, periodicals, reports, and books. Examples of our material include *Science News, New Scientist, Space News, Space Policy, and Nature*. You are welcome to browse through these materials and use them for research, but you must check them out from the Space Studies Administration Office.

**NORTH DAKOTA SPACE GRANT CONSORTIUM AND ND NASA EPSCoR**
The NASA Space Grant Program was established to foster space-related education and research. Space Grant objectives are to establish a national network of universities with interests and capabilities in aeronautics, space, and related fields; develop cooperative programs among universities, aerospace industry, and Federal, State, and local governments; encourage interdisciplinary training, research, and public service programs related to aerospace; recruit and train professionals, especially women, underrepresented minorities, and persons with disabilities for careers in aerospace science and technology; and promote a strong science, mathematics, and technology education base from elementary through secondary levels. Space Grant Consortia have been established in every state, the District of Columbia, and Puerto Rico. Each consortium receives funds to be used in implementing a balanced program of education, research, and outreach.

In 1990, the North Dakota Space Grant Consortium (NDSGC) was established. The Department of Space Studies administers NDSGC. This program provides seed monies for undergraduate and graduate student research, and to develop a space-related educational infrastructure. For more information on NDSGC programs and activities, please contact the consortium director, Dr. Jim Casler, in the Department of Space Studies. Please see [http://ndspacegrant.und.edu/](http://ndspacegrant.und.edu/) for further details.

The North Dakota NASA EPSCoR program is designed to enhance and promote NASA-relevant research at North Dakota's research universities, which include the University of North Dakota and North Dakota State University. Dr. Jim Casler is the director of this program. The primary program of ND NASA EPSCoR is the Research Infrastructure Development (RID) program, which provides faculty seed grants, graduate research assistantships (GRAs), and NASA-relevant travel funding to faculty. The RID program is working to foster and develop Research Focus Areas (RFAs) in North Dakota; two of the RFAs currently include planetary space suit research and astronomical/planetary science research, both of which have been developing strongly in North Dakota in the last few years. Future RFAs are being considered. Another ND NASA EPSCoR program is the NASA Cooperative Agreement Notice (CAN) research solicitation, which offers North Dakota researchers the opportunity to submit up to two proposals annually that can be funded for up to $750,000 each. The CAN solicitations began in FY 2007 and are expected to occur annually for the foreseeable future. For current information, visit the ND NASA EPSCoR website at [http://ndnasaepskor.und.edu/](http://ndnasaepskor.und.edu/).
CAREER CONSIDERATIONS
The majority of Space Studies graduates are seeking work in the various space sectors. You should start building your resume now, consult various books and net resources concerning how to do this. A solid resume’ can help pave the way toward a space opportunity in either the government or the private sector.

You have to know someone and know what position is available before you can expect to be competitive for a posting involving the space program. Government contractors, which research information for various government agencies, offer lucrative starting opportunities for a number of our graduates. Private consulting firms have also hired graduates because of their knowledge concerning space program operations. In addition, satellite communications, remote sensing, and GPS offer new opportunities for employment reflected by the formation of new companies and space commercial activities in these areas.

To get a job, you must know what is happening and how to market yourself. Read Space News and Aviation Week & Space Technology. Learn which companies are getting new space contracts and pursue them. Look at the internet and learn the strong and weak points of each organization you would like to join. Determine whether or not a job is right for you rather than finding out too late that it is not what you want. You should ask the faculty. Frequently the faculty receive calls from organizations seeking our graduates for a position. It helps to tell the faculty members to keep you in mind. The faculty may have connections with different areas of the space community. They can give you pointers, review your resume, introduce you to contacts, and write recommendations, but if you fail to ask, you might not even know that you missed an opportunity.

Finally, important sources of employment information and job leads are your fellow Space Studies graduates. With over 800 alumni working in space-related jobs, they would definitely know where the greatest needs are at any given moment. Once again, you must seek the opportunity and you must be aggressive to obtain a job in the space field.

Organizations that have hired graduates of our Space Studies program include ANSER Analytical Services, Boeing Aerospace, Booz-Allen and Hamilton, Canadian Forces, Earth Observation Sciences, Futron, Hughes Aircraft, Jet Propulsion Laboratory (JPL), Lockheed-Martin, Microsoft, NASA, National Imaging and Mapping Agency (NIMA), National Missile Agency, NOAA, Space Commerce Canada, U.S. Air Force (USAF) and Army Space Commands, U.S. General Accounting Office (GAO), and United Space Alliance (USA).