

GEORGE MASON UNIVERSITY
Volgenau School of Engineering

SYST 659-003: Space Systems Engineering

Spring 2017
Syllabus

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Course Summary

The effective development of space systems is predicated on a firm understanding of the foundational technical and systems engineering components necessary to both comprehend the design task and formulate an appropriate solution. For engineers and technical managers seeking to develop this working knowledge and associated skills, this course will provide an overview of the key elements comprising space systems and an analytic methodology for their investigation. We concentrate on scientific and engineering foundations of spacecraft systems and interactions among various satellite subsystems. With a strong systems engineering context, topics will include fundamentals on astrodynamics, power systems, communications, command and data handling, thermal management, attitude control, mechanical configuration, structures and launch systems. In addition to traditional instruction, a number of case studies and a team design project provide further breadth and exposure.

Course Goal

To provide an introduction and system-level understanding of the elements of a space mission architecture, with an emphasis on application, mission objectives, and conceptual design.

Instructor

Name: Dr. Tom Clemons

Email: tclemons@gmu.edu (preferred method of communication)

Phone: (703) 993-5886

Office: Engineering Building Room 2226

Office Hours: Monday's 2-4pm or by appointment.

Prerequisites:

Recommended: SYST 520 - System Engineering Design

Required Text:

Space Vehicle Design, Second Edition, by Michael D Griffin, James R French, AIAA Education, 2004. ISBN-13: 978-1563475399. (SVD)

Other References and Readings:

Space mission Analysis and Design, Third Ed., James R. Wertz and Wiley J. Larson (Editors), Microcosm, 1999. ISBN-13: 978-1881883104. Chapters 1 - 4, and 10. (SMAD)

Spacecraft Systems Engineering, Fourth Edition, Perter Fortescue, Graham, Swinerd, and John Stark (Editors), Wiley, 2011. ISBN: 9780470750124. Chapters 13, 14 and 20

NASA Systems Engineering Handbook, NASA/SP-2007-6105 Rev 1, Section 4, System Design.

Various other documents of interest

Course Expectations/Policy

1. Graduate work requires dedication and organization. I expect proper preparation every week. You are to log in to the course blackboard site each week and complete the assignments and activities on or before the due dates.
2. Class attendance is essential. Information will be presented that will not necessarily be in the book, and is certain to be needed in course assignments.
3. Regarding electronic devices (such as laptops, cell phones, etc.), please be respectful of your peers and your instructor and **do not engage in activities that are unrelated to class**. Such disruptions show a lack of professionalism and may affect your participation grade.
4. Students are encouraged to interact on homework assignments, but your write-up must be your own. Assignments provide practical, hands-on experience with the ideas presented in the course.
5. Changes to assignment dates and scheduling provided below are possible. I will post changes to Blackboard through email. It is the students' responsibility to keep abreast of any changes. Students must check their GMU email messages on a **daily** basis for course announcements, which may include reminders, revisions, and updates.
6. Students will submit all course deliverables electronically. I have already provided the schedule for these deliverables in this syllabus. That said, there is some flexibility for students to request changes, but you must make these requests well in advance. Should any scheduled event affect a student's participation in class activities and assignments, it is the student's responsibility to coordinate with me prior to the event.
7. Religious observances are one common example of events that might affect students' activities. Students are responsible for planning ahead. Please, refer to the GMU's calendar of religious holidays at http://ulife.gmu.edu/religious_calendar.php.
8. Late assignments, when properly justified, will receive reduced credit in accordance with the late assignment policy (below in this document). I will reward no points for homework turned in after I have posted solutions.
9. Academic Policy: Students must strictly follow all academic policies as given in the Honor System and code. These are available at <http://catalog.gmu.edu/content.php?catoid=27&navoid=5383>.
10. General Policies: All general policies defined in the University Catalog are in place for this course. You can access those at <http://catalog.gmu.edu/content.php?catoid=27&navoid=5440>.
11. It is essential to communicate any questions or problems to me promptly.

Learning Outcomes

- Evaluate the elements of a space system architecture, describe their major interfaces, and communicate key information through prevailing formats.
- Apply fundamental methods of analysis and evaluation used in designing space systems and assessing their performance.
- Develop and assess an overall space system architecture to meet defined mission requirements using systems engineering tools and processes.
- Synthesize a mission concept through a development team project.

Performance-based Assessments and Grading:

1. Homework (30%):

You learn the material through homework and practice. I will assign homework weekly except during exam weeks and is due at the beginning of class the following week. Unless you make prior arrangements, I will not accept late homework. You must show your work to achieve full credit. I will give partial credit for incorrect solutions.

2. Paper Presentation (10%):

Students will select a topic from the syllabus and present a review of a technical paper covering that topic. A 20-minute presentation will be a case study to augment lesson material that week.

3. Exams (40%):

The course will include two exams, one midterm approximately halfway through the school year and a final at the end of the year. The exams will be closed book, and timed. You must show your work to achieve full credit. I will give partial credit for incorrect solutions.

4. Design Project (30%):

Students will develop and assess a preliminary design of an overall space system architecture to meet defined mission requirements using systems engineering tools and processes. You will derive system and subsystem performance criteria from stated mission capabilities and conduct trade-offs between payload and other spacecraft subsystems in addressing these capabilities.

I will assign final grades as follows:

A/A-: 100-93, 92-90%, **B+/B/B-:** 89-87, 86-83, 82-80%, **C+/C/C-:** 79-77, 76-73, 72-70%, **F:** < 70%

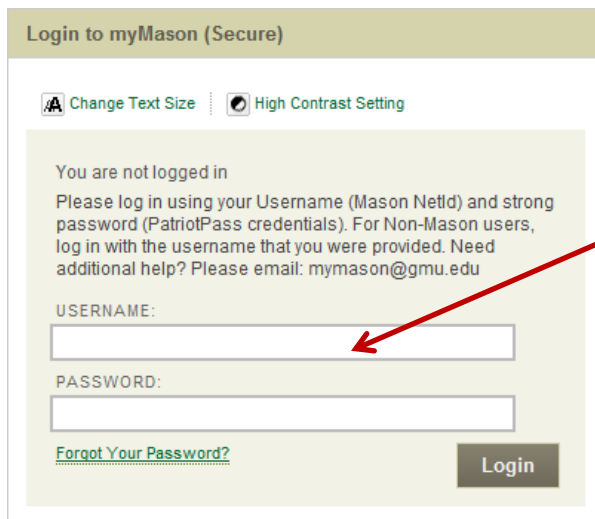
Course Schedule

Dates	Lesson	Reading	Assignment
Jan 25	Introduction – Space Environment	SVD: Chp 1 – 3 SMAD: Wertz – Chp 1	
Feb 1	Spacecraft SE	NASA, SE Handbook SMAD: Chp 2-4 Tatnall: Chp 20	
Feb 8	Payloads	Fundamentals of Remote Sensing	
Feb 15	Communications	SVD: Chp 11	
Feb 22	Astrodynamics	SVD: Chp 4	
Mar 1	Propulsion and Launch Systems Project: MDR	SVD: Chp 5	
Mar 8	Configuration and Structural Design I	Reeves – S/C Design SMAD: Chp 9 SVD: Chp 8	
Mar 15	Midterm Exam		
Mar 22	Spring Break – No Class		
Mar 29	Guest Speaker Project: SRR	SVD: Chp 8	
Apr 5	Attitude Determination and Control	SVD: Chp 7	
Apr 12	Power Systems	SVD: Chp 10	
Apr 19	Thermal Control	SVD: Chp 9	
Apr 26	Ground Segment/TT&C	Fillery – Telemetry, Command, & DH Chatel – Ground Segment	
May 3	Assembly, Integration and Verification Project: PDR	Supplemental reading	
May 10	Final Exam		

Online Learning Community

Instructions for accessing your course via Blackboard

Access to Blackboard is through a portal called MyMason. The URL for the MyMason portal is: <https://mymasonportal.gmu.edu/> . Once there click on the link for this course.

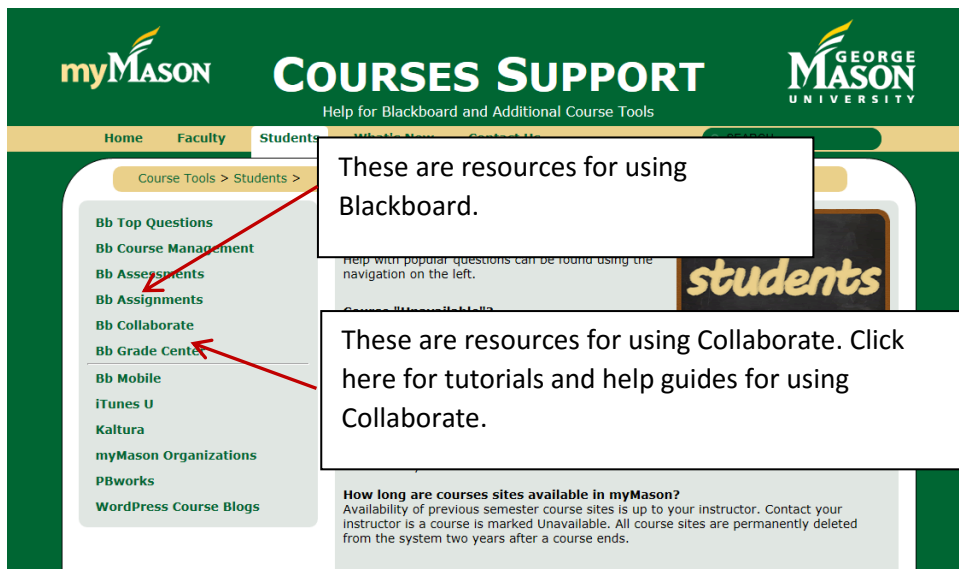


You'll see a screen with a login space.

Login using your Mason netID and password, which is the same as your email username and email password.

Help Files for Using Blackboard

On the right column of your courses page you will see a link for Blackboard help which will take you to this page.



These are resources for using Blackboard.

These are resources for using Collaborate. Click here for tutorials and help guides for using Collaborate.

How long are courses sites available in myMason?
Availability of previous semester course sites is up to your instructor. Contact your instructor if a course is marked Unavailable. All course sites are permanently deleted from the system two years after a course ends.

School Policies

Academic Integrity

Students must be responsible for their own work, and students and faculty must take on the responsibility of dealing explicitly with violations. The tenet must be a foundation of our university culture. [See <http://academicintegrity.gmu.edu/distance>].

Honor Code

Students must adhere to the guidelines of the George Mason University Honor Code [See <http://oai.gmu.edu/honor-code/masons-honor-code/>].

MasonLive/Email (GMU Email)

Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account. [See <https://thanatos.gmu.edu/masonlive/login>].

Patriot Pass

Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Blackboard, University Libraries, MasonLive, myMason, Patriot Web, Virtual Computing Lab, and WEMS. [See <https://thanatos.gmu.edu/passwordchange/index.jsp>].

University Policies

Students must follow the university policies. [See <http://universitypolicy.gmu.edu>].

Responsible Use of Computing

Students must follow the university policy for Responsible Use of Computing. [See <http://universitypolicy.gmu.edu/1301gen.html>]. Students are expected to follow courteous Internet etiquette.

University Calendar

The course follows the university calendar that includes holidays, withdrawal dates, and exam schedules. [See <http://registrar.gmu.edu/calendars/fall-2014/>].

- **Religious Holidays:** A list of religious holidays is available on the University Life Calendar page (<http://ulife.gmu.edu/calendar/religious-holiday-calendar/>). Any student whose religious observance conflicts with a scheduled course activity must contact the Instructor at least 2 weeks in advance of the conflict date in order to make alternative arrangements.

Students with Disabilities

Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu>].

Student Services

University Libraries

University Libraries provides resources for distance students. [See <http://library.gmu.edu/distance>].

Writing Center

The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. [See <http://writingcenter.gmu.edu>].

You can now sign up for an Online Writing Lab (OWL) session just like you sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment! Learn more about the [Online Writing Lab \(OWL\)](#) (found under Online Tutoring).

Counseling and Psychological Services

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu>].

Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights. [See <http://registrar.gmu.edu/privacy>].