AEM 1905 (Freshman Seminar) – Spaceflight with Ballooning **Fall 2011**
2 credits; prerequisite – entering freshman ***version 2: 9/13/11***

Lecture: 3:35 to 5:30 p.m. Tuesdays in Vincent 364 (or Shepherd 394)
Also reserve Saturday, October 29 for our near-space ballooning mission. This is a required all-day class activity. Weather-delay dates: Sunday, October 30 or else on the weekend of November 5 – 6.

Professor: James Flaten
Associate Director of the MN Space Grant Consortium
Aerospace Engineering and Mechanics (AEM) Department
Office: Akerman 205C (in the Akerman/Shepherd skyway)
flaten@aem.umn.edu
612-626-9295 (office) (or 651-399-2423 cell – use sparingly)
Office Hours: 12:30 to 1:30 p.m. on Tuesdays
1 to 2 p.m. on Fridays (if requested by Thursday evening)
or by appointment (Note: right before and right after class are generally poor times to try to schedule an appointment with me)
Teaching assistants: Alex Ngure ngure001@umn.edu 651-278-9024
Joey Senykr senkr001@umn.edu 507-995-1674
Openable Lab (Shep. 394): Joey Senykr 4 to 6 p.m., Monday
Alex Ngure 4:30 to 6 p.m., Thurs.
Seth Frick frick100@umn.edu 10 a.m. to noon, Friday
James Flaten during regular office hours (Tuesday or Friday)
Readings: Articles by Paul Verhage and others (distributed or on-line)
Course Web Site: www.aem.umn.edu/courses/aem1905/fall2011

Brief course description:

Outer space, sometimes called the Final Frontier, has always been difficult to reach due to the tremendous expense of rocket launches and the limited number of launch opportunities. In this hands-on course we will design and build mini-spacecraft and use (relatively) inexpensive helium-filled weather balloons to carry them into "near-space" – the upper reaches of the atmosphere which has many of the same physical properties as outer space. The launch and recovery will be a required class activity tentatively scheduled for the last Saturday in October (this activity is weather dependent, so the actual flight day may need to change). The remainder of the semester will involve data analysis from our balloon mission as well as discussions and activities associated with full-fledged (i.e. outer space) spaceflight, including the scientific accomplishments and engineering challenges of past, current, and future missions.

Brief biography of the instructor:

Dr. James Flaten is the associate director of the Minnesota Space Grant Consortium (AKA MnSGC – http://www.aem.umn.edu/mnsgc), a NASA Higher Education program whose goals include promoting interest in space science and space exploration. Housed in the Aerospace Engineering and Mechanics (AEM) Department, Dr. Flaten's academic background is in experimental physics and he has taught many physics, astronomy, and introductory engineering classes in the past. He enjoys using high-altitude ballooning as a low-cost means of giving college students hands-on experience building and flying space hardware.

Latex notice:

High-altitude ballooning involves the use of latex weather balloons. Direct contact with latex is minimal, but students with known latex allergies (or those concerned about possible exposure)

should contact their health care provider about potential risks of participating in such an activity. Concerned students should arrange with the instructor for launch day assignments that do not involve any direct contact with latex material.

Course Objectives: In this class the student will –

- Collect tips about succeeding in college and practice putting them into practice.
- Learn about outer space and near-space plus spacecraft and space flight in both regions through class discussions plus locating-then-reading scientific literature. (U of MN Student Learning Outcomes – "Can locate and critically evaluate information" and "Have mastered a body of knowledge (at an introductory level) and a mode of inquiry")
- Work as a team to build a miniature spacecraft to perform science experiments and fly it on a high-altitude balloon mission to near-space. (U of MN Student Learning Outcome – "Can identify, define, and solve problems")
- Present design of and results from near-spacecraft, both orally and in writing. (U of MN Student Learning Outcome – "Can communicate effectively")
- Reflect upon the multitude of disciplines, including but not limited to science and engineering, involved in space programs and spaceflight. (U of MN Student Learning Outcome – "Understand the role creativity, innovation, discovery, and expression across disciplines")

Scholastic Conduct:

You will be respected and treated as an honest, honorable person and are expected to treat your instructor(s) and your classmates in a similar manner. Active participation in class activities is expected, but disrespectful behavior towards anyone or actions that disrupt the supportive learning environment will not be tolerated.

As a student of the University of Minnesota, you are expected to be familiar with the Student Code of Conduct:

http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html

In particular, cheating on any assignment, quiz, or exam may result in penalties ranging from receiving a zero on that particular assignment to receiving an "F" for the course and/or being suspended from the University.

In general you will be permitted (indeed, encouraged!!!) to work with your classmates on assignments. When individual work is required, it will be clearly described as such. Any attempt to communicate with another person or view someone else's work or assist another student improperly during a quiz or an exam constitutes cheating and will be dealt with according to University policy.

University of Minnesota Course Policies:

Policies in the following document also apply to this course:

http://www.aem.umn.edu/teaching/syllabi.shtml

Graded aspects of the class:

In this class 50% of your grade will be based on individual effort (40% for written assignments which will include in-class activities (including occasional quizzes) and homework (including writing some essays), and 10% for individual participation in your team (as assessed by instructor and TA observations, plus peer reviews)) and 50% of your grade will be based on the quality of your team's work (20% for your miniature spacecraft (designed, built (quality, on-time delivery), tested, flown, data recovered), 15% for written documentation (3.25 revisions), and 15% for 3 oral team presentations (conceptual, flight readiness, final)). Point values for specific assignments will be announced as we go, but at the end of the semester all the points in each category will be weighted according to the percentages listed above.

Final Exam:

There will not be a final exam in this class. However there will be a final oral presentation, as a team, a semester-end public exhibit, and a final team-written report on your ballooning mission.

Class absence/make-up work policy:

Make-up work will not be allowed for unexcused absences. In the case of excused absences, in-class activities that cannot effectively be made up will simply not count towards your grade. Make-up quizzes and exams will only be offered if all the following conditions are met.

- You have a valid reason for a class absence according to University policy: health issue, family emergency, sanctioned University event, religious observance.
- You contact the professor by phone or e-mail as soon as you know about the absence (nearly always before the class you miss, unless it is a genuine last-minute emergency – you may even know about impending absences at the start of the semester) to explain your situation and make an appointment to see the professor (definitely before the next week's class) to discuss what you missed.
- You provide valid documentation of your excused absence, such as a note from a doctor, when you next see the professor.

Late assignment submission policy:

All assignments will have specific due dates/times and deductions will be made if they are submitted late. These penalties are stiff, so don't turn in things late!

- -10% for assignments received (hard copy or electronically) on the due date but later than the due time (e.g. after class, if due at the beginning of class)
- -20% for assignments received on the following business day (e.g. things turned in on Wednesday if due Tuesday; things turned in on Monday if due Friday, etc.)
- -50% for assignments received later than the following business day but within 1 week of the original due date
- No credit for assignments more than 1 week late

Checking Scores Online:

You can check your scores for the class in the AEM Student Record System at

www.aem.umn.edu/srs

It is a good idea to check to make sure that each of your scores has been correctly entered in the system – errors in data entry do occur! *Questions or comments about grading must be raised within one week of scores being posted, after which grades will be considered final.*

Letter grades:

Letter grades will be assigned according to the following cutoffs.

93.00 – 100 %	A	77.00 – 79.99 %	C+
90.00 – 92.99 %	A-	73.00– 76.99 %	C
87.00 – 89.99 %	B+	70.00 – 72.99 %	C-
83.00 – 86.99 %	B	67.00 – 69.99 %	D+
80.00 – 82.99 %	B-	60.00 – 66.99 %	D
		00.00 – 59.99 %	F

There cut-offs should be considered tentative. I reserve the right to lower (but not raise) one or more of these cut-offs at the end of the semester.

Feedback about this class, delivered in person or sent by e-mail, is always welcome.

< *The contents of this syllabus are subject to modification if the need arises.*>

Tentative Calendar for AEM 1905: Spaceflight with Ballooning **Fall 2011**

version 1: 9/6/11

Tuesday, Sept. 6

Introduction to class (on-line pre-instruction HARP survey)
Discussion of space (& near-space), spacecraft (& near-spacecraft), spaceflight (…), etc.
Anasonde activity, to motivate science uses of balloons and also radio communication

Tuesday, Sept. 13

BalloonSat mission overview: atmosphere, experiments, payload construction, flight
Discussion of sample student payloads
Demonstration of HOBOs, flight computers, sensors, cameras
Introduction to main payload-building assignment, documentation, and design reviews
Team-forming activities and preliminary payload planning using 3-D mock-ups

Tuesday, Sept. 20

Distribution and discussion of Team Project (Written) Documentation template
Team Project Documentation – Rev 0: Section assignments, hardcopy due in class
Distribution and discussion of Proposal/Conceptual Design Review (CDR) template
Some class time to work on Proposal/Conceptual Design Review (CDR)
Discussion of electronics then learn-to-solder activity and begin building heater circuit
Introduction to Author/Peer Reviewer assignment
Movie Night 1!

Tuesday, Sept. 27 *(Slides due at noon – (i.e. BEFORE class))*

Proposal/Conceptual Design Reviews (CDR) (8-10 minutes per team, oral with slides)
Feedback on design and Authority to Proceed (ATP); equipment/materials checkout
Distribute and discuss weather station and flight computer kits
Begin soldering the weather station and flight computer and constructing payload shell

Tuesday, Oct. 4 (build week: no regular class – instructor out of town)

Finish all soldering projects: heater, weather station, BSE flight computer
Work on payload body construction
Required meeting with TA at some point this week to show off your progress

Wednesday, Oct. 5

Essay A1: first draft due (electronically) by 5 p.m. to peer reviewer (copy to instructor)

Thursday, Oct. 6 (or within 24 hours of receipt, if Essay A1 is late)

Essay A1: peer reviewer comments due (electronically) by 5 p.m. to author (copy to instructor)

Tuesday, Oct. 11

Discussion of Spacecraft Systems and Systems Engineering
In-class testing of soldering projects: heater, weather station, flight computer
Class time to work on construction, integration, and testing (esp. mechanical testing)
Tips about camera use and about programming flight computers and HOBOs

Wednesday, Oct. 12

Essay A1: final draft due (electronically) by 5 p.m. to instructor

Friday, Oct. 14

Team Project Documentation – Rev A: Design sections, due electronically by 5 p.m.

Tuesday, Oct. 18

Class time to work on construction, integration, and testing (esp. thermal and electrical)
Data collection from "Day in the Life" testing
Class time to work on Flight Readiness Review (FRR)

Movie Night 2!

Tuesday, Oct. 25 *(Slides due at noon – (i.e. BEFORE class))*

Flight Readiness Reviews (FRR) (12-15 minutes per team, oral with slides)

Flight prediction (software), launch logistics, tracking logistics, recovery logistics

Class time to finalize payloads (especially rigging); weigh-in/turn-in if finished

Thursday, Oct. 27

Final deadline for payload weigh-in/turn-in at noon

Friday, Oct. 28

Team homework (GPS hunt and flight predictions) both due by e-mail by noon

Optional (interesting, but not for class points) – packing for the flight, 2 to 4 p.m.

Saturday, Oct. 29 (alternate dates – Oct. 30th or Nov.5th or Nov. 6th)

Launch day (actual launch site and flight timing TBA) – approximate schedule will be depart from Akerman ~6:30 a.m., launch ~9:30 a.m., flight ~2.5 hours, recovery and return to the Twin Cities may take until late afternoon – wear long pants, closed-toed shoes, and a warm jacket – bottled water and light snacks will be provided, but bring a sack lunch or some money for a fast-food drive-through

Tuesday, Nov. 1

Discussion of Gravity, Orbits, and Mission Design

Class time for data extraction from payloads, data analysis tips, preliminary data analysis

Wednesday, Nov. 2

Essay A2: first draft due (electronically) by 5 p.m. to peer reviewer (copy to instructor)

Thursday, Nov. 3 (or within 24 hours of receipt, if Essay A2 is late)

Essay A2: peer reviewer comments due (electronically) by 5 p.m. to author (copy to instructor)

Friday, Nov. 4

Team Project Documentation – Rev B: Design/Build sections, due electronically by 5 p.m.

Tuesday, Nov. 8

Discussion of Launch Vehicles: Past, Present, and Future

Class time to continue work on data analysis and generate data analysis visuals/graphs

Wednesday, Nov. 9

Essay A2: final draft due (electronically) by 5 p.m. to instructor

Tuesday, Nov. 15 *(Data visuals/graphs due at noon – (i.e. BEFORE class))*

Discussion of Telemetry and Communication Systems

Class time to work on Final Team Presentation (FTP)

Feedback offered on data analysis visuals/graphs

Tuesday, Nov. 22 *(Slides due at noon – (i.e. BEFORE class))*

Final Team Presentations (FTP) (20 – 25 minutes per team, oral with slides)

Tuesday, Nov. 29

Discussion of Re-entry and Landing Systems

Design a ballooning mission to another solar system body

(Possible) Movie Night 3!

Friday, Dec. 2

Team Project Documentation – Rev C: Complete document, due electronically, 5 p.m.

Tuesday, Dec. 6

Possible: In-class writing assignment “Essay B” on most recent movie

Design a ballooning mission to another solar system body (continued)
Class time to work on mission-summary poster and payload/laptop exhibit

Tuesday, Dec. 13

3:35 to 4:30 p.m: Public reception in Akerman Hangar Lobby (optional – help with balloon inflation before class, starting about 3 p.m.) to talk about mission, with posters and payload/laptop exhibit

Course evaluations (on-line post-instruction HARP survey)
Wrap-up discussion topic: Where do we go from here?

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