

Tentative Calendar for AEM 1905: High-Power Rocketry

Fall 2016

Version 4: 11/21/2016

Tuesday, Sept. 6

Introduction to class

Discussion of model rockets vs high-power rockets vs outer-space rockets

Overview of (model rocket and high-power rocket) construction techniques

Saturday, Sept. 10

Optional field trip – Tripoli MN monthly public rocket launch (weather permitting) from near North Branch, MN. Tentative schedule: leave from Akerman at 9:00 a.m. and return approximately 2:00 p.m.; bring something to drink, bring a lunch or else cash to buy food (brats) from a vendor

Tuesday, Sept. 13

Discussion of rocket structures

Introduction to rocket flight stability: center of gravity (CG) and center of pressure (CP)

Introduction to the “Round 1” (R1) kit-rocket assignment

Assignment of R1 teams; distribution of rocket kits; fin-can/epoxy construction exercise

Plan an out-of-class all-team meeting to establish a construction schedule and to work on

Preliminary Design Review (PDR) slides

Tuesday, Sept. 20 (*PDR slides are due by 1 p.m. (i.e. BEFORE CLASS) by e-mail or bring in person to office hour*)

Preliminary Design Review (PDR) (oral: 6-8 minutes per team) for Round 1 rockets

Continue discussing CG and CP then assign CG and CP Excel spreadsheet homework

Introduction to rocket propulsion and rocket motion

Some in-class time to work on Round 1 rockets

Tuesday, Sept. 27

Continue discussing rocket propulsion and rocket motion – thrust curve, velocity calculations, descent rate calculations, assign calculation homework

Discussion of trajectory simulations (and other calculations) with spreadsheet and with OpenRocket

Use OpenRocket to calculate CG and CP – final decision on placement of top rail button

Some in-class time to work on R1 rockets and Flight Readiness Review 1 (FRR1) slides

Tuesday, Oct. 4 (*FRR1 slides due by 1 p.m. (i.e. BEFORE CLASS) by e-mail or bring in person to office hour*)

Flight Readiness Review 1 (FRR1) (oral: 8-10 minutes per team) for Round 1 rockets

Discussion of logistics for flight day and what to expect – launch organization, safety procedures, folding parachutes, grinding down delay charges, mounting sirens, mounting radio beepers, using Altimeter Two's to collect flight data, ejection charge calculations, adding powder to motor eject (if necessary), discussion of venting parachute volume versus venting av/payload bay

Some time to finalize Round 1 rockets and make a check-out appointment

Thursday, Oct. 6

4 p.m. deadline for Round 1 rocket completion and check-out (make an appointment with Dr. Flaten or Sasha or Ryan)

Painting is allowed until midnight Thursday, but not into the day on Friday

Saturday, Oct. 8 (with TA's – Prof. Flaten will be out of town Oct. 7 and 8) (poor-weather back-up dates (probably) Oct. 9 or Oct. 15 or Oct. 16)

Required field trip – Tripoli MN monthly public rocket launch outside of North Branch
Tentative schedule: meet at Akerman hangar lobby at ~8:30 a.m., vans depart ~8:45 a.m., launch rockets ~10:30 a.m. to 1:30 p.m., return to campus ~4:00 p.m.; bring something to drink, bring a lunch or else cash to buy food (brats) from a vendor, be prepared to walk in dense woods and/or deep corn to recover rockets (wear long pants and closed-toed shoes), bring a jacket!

Tuesday, Oct. 11

Introduction to the “Round 2” (R2) rocket assignment: design then scratch-build a dual-deploy rocket that can survive a very-high-thrust motor, custom av-bay, ext. video
Introduction to Round 2 Team Project Documentation template. In-class team meeting to select roles and start planning for Round 2 design/build – assign some people to CAD and others to OpenRocket. Submit Rev 0, and keep a copy, before the end of class.
Introduction to partner-writing-assignment and select partners (pair up with someone not on your R1 team). Watch Movie 1 in class (60 min). Watch Movie 2 outside of class with your partner, if possible by the end of next week (60 min). (TA’s will announce out-of-class movie show times and locations.)

Some time to work on Post-Flight Analysis (oral presentation) of Round 1 rocket

Tuesday, Oct. 18

Post-Flight Analysis for Round 1 rockets (even if launch date was delayed till Oct. 15 or 16) (oral: 4 - 6 minutes per team). *You do not need to submit slides before class.*
Avionics bay (av-bay) construction and wiring; introduction to programming altimeters
Adding components to OpenRocket models
Introduction to CAD software and laser cutting and 3D printing
Class time to work on design and Rev A (due by e-mail next Wednesday) of team-written Project Documentation for Round 2 rocket

Tuesday, Oct. 25

Final instructions about the movie essays (written with a partner/editor) now that everyone has watched both movies.
Some class time to work on Rev. A of Team Project Documentation for Round 2 rocket (due Wed. 10/26, see below) and other aspects of Round 2 – design/simulate, etc.
Make an ATP (Authority to Proceed) appointment with Dr. Flaten for Thursday or Friday of this week. Team lead and parts guru must attend. Other members too, if possible.

Wednesday, Oct. 26

Rev. A of Team Project Documentation (Preliminary Design Report 2) for Round 2, due by e-mail by 5 p.m.

Thursday, Oct. 27 or Friday, Oct. 28

Appointment by team representatives (team lead and parts guru, at least) with Dr. Flaten to discuss design and get Authority to Proceed (ATP); get additional parts

Tuesday, Nov. 1

Discussion of outer-space unmanned (non-military) rockets: missions, payloads, launch vehicles, (often-complex) trajectories
Some class time to work on Round 2 rocket
Essay: first draft due (electronically) by 10 p.m.; e-mail draft to your editor and copy Dr. Flaten in the same e-mail message

Friday, Nov. 4

Essay: editor comments due (electronically) by 10 p.m.; e-mail feedback to the author and copy Dr. Flaten in the same e-mail message

Tuesday, Nov. 8

Discussion of systems engineering

In-class: more discussion of altimeter wiring and programming, more about data analysis, camera testing, etc.

Some class time to work on Round 2 rocket and FRR2 slides

Make an appointment to do ejection testing outside of class, before the weekend

Essay: final draft due (electronically) by 10 p.m.; e-mail final draft to Dr. Flaten and (optional) copy your editor

Tuesday, Nov. 15 (*FRR2 slides due by 1 p.m. (i.e. BEFORE CLASS) by e-mail or bring in person to office hour*)

Flight Readiness Review 2 (FRR2) (oral: **8-10** minutes per team) for Round 2 rocket – this should include ejection test results

Some class time to finalize Round 2 rocket and work on Rev. B of Team Project Documentation

Wednesday, Nov. 16 (moved to Nov. 21)

~~Rev. B of Team Project Documentation (Construction Progress / Pre-Flight Report) due by e-mail by **5 p.m.**~~

Thursday, Nov. 17 (moved to Nov. 18)

~~4 p.m. deadline for Round 2 rocket completion and check-out.~~

Friday, Nov. 18

Noon deadline for Round 2 rocket completion, including painting, and check-out.

Saturday, Nov. 19 – LAUNCH RESCHEDULED FOR DECEMBER 3, 2016

Field trip to fly Round 2 rockets. This trip is not technically required, but every rocket needs a “launch team” of at least 3 people (and preferably more). Tentative schedule: meet at Akerman hangar lobby at ~8:30 a.m., vans depart ~8:45 a.m., launch rockets ~10:30 a.m. to 12:30 p.m., return to campus ~3:00 p.m. No food vendor. Dress warm!

Monday, Nov. 21

Rev. B of Team Project Documentation (Construction Progress / Pre-Flight Report) due by e-mail by **5 p.m.**

Tuesday, Nov. 22

Discussion of EDL (Entry, Descent, and Landing) – applies to all high-power flights but only to certain outer-space missions

~~Rest of class time to look at Round 2 videos, download altimeter data, work on analysis of Round 2 flight and Post-Flight Analysis slides~~ (you will need to do this out of class instead since no class period between Dec. 3 (launch) and Dec. 6 (oral presentations))

NEW: Catch up on in-class topics. Some in-class preparation for Tripoli Level 2 test.

Tuesday, Nov. 29

Discussion about the Past, Present, and Future of Human Spaceflight

Take (unofficial) Tripoli “Level 2” certification test (study notes will be provided)

Some class time to work on Rev. C. and Round 2 Post-Flight Analysis slides

Friday, Dec. 2

Rev. C of Team Project Doc. (Post Flight / Final Report) due by e-mail by **5 p.m.**

Tuesday, Dec. 6 (*Slides due by 1 p.m. (i.e. BEFORE CLASS) by e-mail or bring in person to office hour*)

Post-Flight Analysis for Round 2 rockets (oral: 8-10 minutes per team; with data plots; no template provided)

In-class exercise – some preliminary work on a competition rocket design

Some class time to work on public exhibit preparation

Friday, Dec. 9

Rev. C of Team Project Doc. (Post Flight / Final Report) due by e-mail by **5 p.m.**

Tuesday, Dec. 13

Course evaluations

High-Power Rocket Display in the Akerman hangar **from about 4:15 to 5:15 p.m.** Invite your friends and family! Show off both Round 1 and Round 2 rockets, discuss flight results from both Round 1 and Round 2, display Rev. C, show launch and in-flight videos (bring a laptop on which to show videos, slides, etc.)

Wrap-up discussion topic: Where do we go from here?

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