# ENAE484 Specialty Teams

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# ENAE 484 Course Overview/Design Project

- Course Overview
  - Goals
  - Web-based Content
  - Syllabus
  - Policies
- Fall Recap
- Spring Planning

# Contact Information


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# Goals of ENAE 483/484

- Learn the basic tools and techniques of systems analysis and space vehicle design
- Understand the open-ended and iterative nature of the design process
- Simulate the cooperative group engineering environment of the aerospace profession
- Develop experience and skill sets for working in teams
- Perform and document professional-quality systems design of focused space mission concepts

# Web-based Course Content

- Data web site at **http://spacecraft.ssl.umd.edu**
  - Syllabus and course information
  - ENAE 483 lecture notes
- Interactive web site at **http://elms.umd.edu**
  - Surveys and comment board
  - Gradebook
- Collaborative design web site at Google Docs (invitation should be forthcoming)

# A Note About Communications

- In a group of 42 people, there are $2^{42}$=4.4 *trillion* possible communication structures (and 861 pairs)
- You are graded on the work you do, not just what winds up in the final report
- It is critical to document your work and communications as they happen
  - Everything should go through the Google site
  - Don't text, phone, IM, etc., except for trivial stuff
  - You'll be happy it's archived when the time comes to do design reviews and write the final report
  - You don't get credit for what the faculty can't see

# Syllabus/Schedule/Milestones

- 1/28: First day of class
- 2/6: Review plans for hardware activities
- week of 3/3: Preliminary Design Review
- 3/13: Final report outline due
- 4/10: Program architecture freeze review
- week of 4/28: Critical Design Review
- 5/13: Last day of class/Final Report due

# Grading Policy

- Everyone speaks at PDR and CDR
- Each person receives two 0-10 grades at each design review
  - "Technical": quality, quantity, and applicability of technical work
  - "Style": quality of oral presentation, slide materials, and demonstrated level of effort
- Each person receives a 0-10 score on individual contributions to comprehensive final report

# A Note about the Grading Algorithm

- The scale is necessarily subjective, and spread out to provide greater resolution on evaluations
- Rough guidelines
  - 10: perfect; I can't think of anything to do better
  - 9: thorough analysis, provides profound insight
  - 8: really good analysis, maybe missing minor points
  - 7: good analysis, not all that thorough
  - 6: adequate analysis, just covers basic topic
  - 5: minor mistakes without mitigating contributions
  - 4: major mistakes, generally clueless
  - 0-3: handwaving, trying to snow the faculty

# Grading Policy - continued

- Each person receives two 0-10 scores from peers at end of class
  - "Technical": quality and importance of contributions
  - "Teamwork": reliability, dependability, extra effort in organizing and communications, etc.
- Qualitative faculty assessment of level of effort, attendance, participation, contributions "above and beyond", etc.
- CDR grades count double, final report grade counts triple other grades

# A Note on Grading

- In all presentations and publications, you should strive for high information bandwidth - clear and concise technical communications
- The final report is a single, unified, comprehensive report on all activities of the year in 483/484
  - Fluff, handwaving, and obvious padding will (dramatically!)lower your score
  - The final report represents 14+ weeks of work, formally assessed at 9+ hours/week (3 credits) - if you can summarize everything in a couple of pages, you probably don't deserve to pass this course

# Accomplishments of the Fall Semester

- Covered techniques for systems analyses and design of space vehicles
- Detailed studies of systems design, crew systems, loads/structures/mechanisms, power/propulsion/thermal, and avionics by 11 parallel groups
- Development of focus on variable gravity station
- Started brainstorming on what to do for the hardware portion of 484

# Initial Goals for This Term

- Extend design activities to full system architectures
- Extend design analysis to finer levels of detail
- Get started with experimental tasks
  - Plan out tests for both neutral buoyancy and 1g habs
  - Decide on hab designs and start modifying habs
  - Critical/long-lead-time items on order by next week
- Successfully complete X-Hab CDR (Feb. 12)
- Revise term schedules based on real dates
- Get started with analytical trade studies, detailed design and analysis, and hardware development

# Bottom Line Goals for this Term

- Perform a systems architecture analysis and detailed designs of component systems for a multi-phase deep space habitat
- Perform experimental research on habitat design in 1g, microgravity, and lunar and Mars gravities
- Meet requirements and exceed expectations of NASA X-Hab program
- Meet requirements and exceed expectations of RASC-AL competition
- Compete in and win RASC-AL in June

# X-Hab Program Deadlines

- 2/12 - X-Hab Critical Design Review (telecon)
  - Complete habitat designs
  - Complete testing plans
  - Overview of progress to date
  - Schedule for remainder of term
- ~March - Progress Report #1
- ~April - Progress Report #2

# RASC-AL Competition Deadlines

- May 31
  - 15-page summary paper
  - 40-minute presentation (PowerPoint)
- June 17-19 (Cocoa Beach, FL)
  - 40-minute presentation
  - Poster presentation

# End Goal: RASC-AL Competition

- First Place 2008, 2009, 2010
- 2013:
  - First place, Exploration theme
  - Second place, undergraduate division
  - Second place, overall

# RASC-AL Theme Requirements

- "Enabling Long Duration Missions through Holistic Habitat Design"
- Look for synergistic ways to get increased effectiveness of component systems (e.g., structures, shielding, logistics, spares)
- Specific interest in reliability, maintainability, and automation; innovative structures; multiuse logistics packaging
- Demonstration through analysis and prototyping

# RASC-AL Evaluation Criteria

- Scientific evaluation and rationale of mission destinations for the development of an exciting and sustainable space exploration program
- Synergistic application of innovative capabilities and/or new technologies for evolutionary architecture development to enable future missions, reduce cost, or improve safety
- Key technologies, including technology readiness levels (TRLs), as well as the systems engineering and architectural trades that guide the recommended approach
- Reliability and human safety considerations in trading various architecture options
- Assessment of how the project is planned and executed, including the project schedule, test and development plan, and realistic annual operating costs
- Education and public outreach activities

# ENAE 484 Program Requirements

- Hard annual funding limit of $3B
- Goal of operational funding limit of $1B/yr
- Goal is to support Asteroid Redirect Mission (2021), support human Mars mission by 2030
- Consider both SLS Block 1/Orion and Falcon Heavy/Dragon launch/transport options and analyze implications
- Perform probabilistic risk assessment of program and individual missions
- Identify critical technologies and current TRLs

# External Involvement

- Team products will be sent to NASA, DOD, and local industry for critiques
- Space professionals from the area (and from JPL) will be coming to PDR and CDR
- Involvement in NASA design competitions
- Summary paper abstract submitted to AIAA Space 2013 conference

# Education/Public Outreach

- No longer part of RASC-AL judging, but still a good idea and the right thing to do
- Focus on public outreach through Maryland Day displays and demonstrations
- Hard goal of 100% participation
- Plan to be here for Maryland Day, April 27, 2014

# Class Sessions – Logistics

- Welcome to the new Aerospace Design Lab!
- We will always be meeting in ADL for normal classes unless we run into particular problems
- Be prepared in every class to give short informal description of your current work and recent results
- Will be arranging in-class reviews and focused design discussions as progress merits it
- It's your project and your team - organization is (pretty much) up to you!
- You are responsible for organizing your reviews

# Class Sessions – Philosophy

- Class time is critical for communication and group decision-making - we expect you to come and participate in every class session
- Remember the 861 possible two-person interactions - no other communication mode will be as effective as face-to-face interaction in class!
- It is quite likely you will also need to find additional time(s) for more class interaction
- Faculty are a resource, will answer questions and provide guidance as requested, but are not running the design effort - you are!

# Let Us Be Totally Clear About…

- We do recognize and reward leadership and organization, but every member of the team should make real and significant technical contributions
- We are looking for critical thought, not just parroting prior work
- Every task, whether analysis or building, should be performed with rigorous attention to engineering detail (i.e., no "catalog shopping" or "cut and try")
- Our expectations are no less than they would be for a group of professional engineers
- Don't forget to have fun!