ASTR 5780, ASEN 5440:
Mission Design and Development for Space Sciences

Location / Time:

AERO 232
T/Th 10am – 11:20am

Instructors

Kevin France, APS

Robert M

do the measurements alone close the science question? If not, what supporting modeling and analysis/interpretation required?

2. **Instrument**: determine the instrument(s) necessary to make the measurements above. Quantitatively demonstrate that the selected instruments can make the measurements with the required fidelity. The instrument performance is tied back to the science questions, through the measurement requirements, in an important table known as the Science Traceability Matrix.
3. **Spacecraft**: The spacecr

Specific APS undergraduate student prerequisites include: Permission of instructor.

Specific AES undergraduate student prerequisites include: Permission of instructor. Recommended background: senior undergraduate level orbital mechanics, electronics, and/or mission design.

Reading

All suggested reading for the course is available on the Canvas course website. While none of this reading is strictly required, we strongly recommend you familiarize yourself with these documents and highlight important sections (which we will help identify). The important documents include:

- **NASA, Research Opportunities in Space and Earth Sciences (ROSES 2019)**. ROSES is not a funding opportunity on its own, but rather a compendium of opportunities. The ROSES documentation is released once per year, usually in February, to outline what opportunities will be available to proposers in the next year.
- **Astrophysics Small Explorer Announcement of Opportunity 2019**. The Small Explorer class, or SMEX mission, is the entry level into NASA missions. These are $145 million missions involving multiple institutions. The AO will give students an idea of what goes into one of these larger proposals.
- **Decadal Surveys (2010-2020)**. Every 10 years, each of the four science areas (Astrophysics, Heliophysics, Planetary Science, and Earth Science) releases a “Decadal Survey” of the state of the science community, the critical science that needs to be addressed in the coming decade, and the missions that are recommended. The astrophysics decadal survey will be running concurrently with this class and we will use real-time examples of the decadal survey process to reinforce classroom discussions.
- **NASA Science Plan (2014).** The Decadal Surveys are commissioned by the National Academies of Science (NAS); they are not strictly NASA-related. In the Science Plan document, NASA pulls directly from the Decadal Survey to outline the goals for the administration.
- **NASA Strategic Plan (2014)**. While the Science Plan relates to science goals for the Science Mission Directorate (SMD) of NASA, the Strategic Plan is a higher-level document for all of NASA, including technology development, human space flight, and education.
- **NASA Technology Roadmaps (2015-2019)**. The Technology Roadmaps come from the Space Technology Mission Directorate (STMD), which focuses on the development of new technologies for NASA. The Roadmaps outline priorities for the coming decade; small satellite missions can often target these priorities to enhance their relevance to NASA.
- **NASA Systems Engineering Handbook Rev 2 (2016).** The NASA SE Handbook describes NASA’s process for conducting space missions. Missions conducted outside of NASA, but funded by NASA, need to show NASA that they have a reasonable Systems Engineering Management Plan that emulates NASA’s established processes.
- **Scientific and Instrumentation Journal Articles** will be assigned based on science and instrument development concepts developed in class.

Subject Outline

1. Introduction to space missions and NASA proposal opportunities
2. Community science priorities, introductory and detailed science investigations
3. Introduction to science topics in Heliophysics, Astrophysics, and Planetary Science
4. Proposal science topic definition for semester mission/proposal projects
5. Science Traceability Matrix

6. Requirements definition, measurements and instrumentat]n

carrier pigeon. If you know in advance that you will not be on campus for a due date, you may submit your assignment to the instructors any time prior to the due date or through e-mail.

Grading

Grades on individual assignments and for the overall course are set based on the following criteria:

A, A-	Superior understanding of the material beyond the course requirements; excellent technical work
B+, B	Comprehensive understanding of the material; strong technical work
B-	Adequate understanding of the material; complete technical work
C	Barely adequate understanding of the material and minimally sufficient technical work
D	Poor technical work
F	Unsatisfactory performance

Activities	%
Homework	**35%**
Concept Paper	**10%**
Proposal/Presentations	**45%**
mid-semester slides	5%
mid-semester oral	5% erd
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Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In t