

# **Course Syllabus**

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## ***Aerospace Senior Projects (ASEN 4018 & 4028) Fall 2005 and Spring 2006***

### **1.0 Document Scope**

This document is the Syllabus for the two-semester Aerospace Senior Projects sequence. This sequence includes *ASEN 4018 Senior Projects I: Design Synthesis* and *ASEN 4028 Senior Projects II: Design Practicum*. The sections below provide basic course information and define how projects are formulated and how grades are determined.

### **2.0 Course Description**

#### **2.1 Objectives**

The objectives of the ASEN 4018/28 Senior Projects course sequence are:

- to teach standard professional aerospace engineering practices,
- to teach the elements of conceptual and detail design,
- to teach the elements of fabrication, integration, verification and test,
- to provide an opportunity for students to develop expertise in their particular areas of technical interest, and
- to integrate design analysis methods learned in prior courses.

#### **2.2 Pre-Requisites**

##### **2.2.1 Pre-Requisites for ASEN 4018**

Students in ASEN 4018 are required to have Senior academic standing at the beginning of the Fall semester. (4 credits)

We expect you to have completed all the required Aerospace courses through the Junior year. If you have not, you must discuss this with the Course Coordinator.

##### **2.2.2 Pre-Requisites for ASEN 4028**

ASEN 4018 and the consent of the instructor for ASEN 4028 are pre-requisites for ASEN 4028. (4 credits)

Students who have not successfully completed ASEN 4018 with at least a grade of C will not be allowed to register for ASEN 4028.

## 2.3 Course Meetings

### 2.3.1 ASEN 4018, Fall 2005

Lectures: MW, 4:00-4:50, ECCR 245

Labs: TR, 3:00-4:50, ECCR 245

In addition, the Aerospace Lockheed-Martin room is reserved exclusively for students in Senior Projects.

### ASEN 4028, Spring 2005

Lectures: MW, 4:00-4:50, ECCR 245

Labs: TR, 3:00-4:50, ECCR 245

### 2.3.2 Scheduling of Reviews

All reviews will be scheduled during the regular class times. All students must attend all reviews. Attendance at reviews is a component of your grade (See Section 6.3.5).

All review material must be submitted by a deadline given in the assignment for that review. The order for reviews following this deadline will be random.

## 2.4 Course Content

### 2.4.1 ASEN 4018

Students work in project teams to conceive and design their projects. The semester includes all design steps from conceptual design to critical design. Detail drawings, schematics and specifications are produced and reported at a Critical Design Review and in a written Final Report. Prototypes and lab-scale demonstrators are fabricated to show the feasibility of the crucial components.

### 2.4.2 ASEN 4028

Students work in the same project teams from ASEN 4018 to fabricate, integrate and verify their projects.

The students fabricate the components of their project, including mechanical, electrical, and software designs. The parts are integrated and function is verified and compared with the original requirements that they specified in ASEN 4018. All machining, with the exception of minor repairs, should be completed by *Last Machining Day*, 17 March 2005.

Physical test data is required for all projects as part of their verification. All data must be obtained by *Last Data Day*, 14 April 2005. After this date no support by the electronics lab will be provided.

Project results are presented in a Final Presentation and in a comprehensive written Final Report.

## 3.0 Resources

### 3.1 Web Site

The course web site is:

<http://www.colorado.edu/ASEN/SrProjects>

This web site archives copies of all course documents.

### 3.2 EMail List Server

All students, faculty and staff must subscribe to the class EMail list. Subscribe to the list by sending EMail to [listproc@lists.Colorado.EDU](mailto:listproc@lists.Colorado.EDU). Include the following in your message body (the <>'s just mean 'put your stuff here' so don't include them):

subscribe aesseniorprojects <your-full-name>

### 3.3 Project Costs

#### 3.3.1 Budget

Project costs are born by both the Aerospace Engineering Department and by Project Customers. The budget for each project from the Aerospace Department is \$4,000. Project Customers set forth available support funds and other resources, such as facilities, in the Project Definition Document.

#### 3.3.2 Procedures

The financial management requirements are set forth in course document [AES-SRP-004](#).<sup>1</sup> Students are required to follow the procedures described there.

#### 3.3.3 Carry-Over Funds

Multi-year projects may not carry over funds left unspent at the end of ASEN 4028.

## 4.0 Student Requirements

### 4.1 Project Teams

There will be a maximum of 8 project teams. The teams will consist of 7 to 9 students and will be formed in consultation with the PAB during the first week of class. Different projects will require a different set of skills. Project teams should balance the required skills against the background and interests of the proposed team members. Teams must demonstrate that their project team is balanced in this regard. When necessary skills are to be developed as part of the project, the team is responsible for demonstrating which students within the team will develop these skills.

Each team needs to identify by formal election team members that take on the following responsibilities:

- Project Manager
- Chief Financial Officer
- System Engineer
- Manufacturing Engineer
- Safety Engineer

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<sup>1</sup> Referenced Documents may be found on the course web site given in Section 3.1

## 4.2 Safety

Safety must be a primary concern for all students, faculty, and staff in Senior Projects. All must take required courses for use of Department and/or ITLL shops. The safety engineer needs to take an environmental health and safety training.

## 4.3 Text

There is no text for this course.

## 4.4 Notebooks

Students are required to keep a bound paper notebook. All project notes must be kept in these notebooks. Notebooks will be available for inspection at all weekly meetings.

*Notebooks must be turned in at the end of each semester when your group submits your final report for the semester. Your notebooks are used during the assignment of grades for the semester.*

Notebooks from the Fall will be returned for use in the Spring.

## 4.5 Weekly Time Sheets

All students must complete and send Weekly Time Sheets (WTS) to their project manager who combines all WTS of the team into one file and sends this file to the project advisors by email before the weekly project team meeting.

The time sheet file should be named as follows:

<Project acronym>\_<last day of reporting period>.doc

*WTS's are used to document your progress. The Project Advisory Board (PAB) will consult your WTS's when determining your grades.*

A template for the WTS will be posted to the course web site.

## 4.6 Team Meetings

The student teams will have at least 2 meetings per week where one of these meetings is with their faculty advisors. The meeting with the faculty advisor should be scheduled during the official lab hours. The project manager is responsible for coordinating all aspects of the team meetings. This includes the following:

- a meeting agenda to be sent out 24 hours prior to the meeting to all team members, the faculty advisors, and the course coordinator
- meeting minutes providing a list of persons present and summarizing discussion topics and action items. All action items should be assigned to an individual team members, specify tasks and deliverables, and have a due date.

## 4.7 Project Web Site

Student teams must maintain a project web site. The address of this web site will be linked from the course web site. Information on the web site as a minimum must include:

- Project Team Members (including name and email information)
- Project Summary

- Project Definition Document
- Project Status

## 5.0 Course Faculty and Staff

Course faculty and staff responsibilities are defined in AES-SRP-002.

### 5.1 Course Coordinator

Prof. Kurt Maute  
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Office Phone: 303-735-2103  
EMail: Kurt.Maute @ Colorado.edu  
Office Hours: during lecture and lab hours

Prof. Scott Palo  
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### 5.2 Project Advisory Board Faculty

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### 5.3 Staff

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### 5.4 What do the Course Faculty and Staff Do?

All course faculty and staff serve on the PAB. The purposes of the PAB are:

- to provide a crosssection of relevant professional expertise to support the student projects
- to provide timely, actionable feedback on the quality of team progress, and
- to determine grades for the course.

Students should look to the course faculty and staff for:

- Experience in system engineering, interactions, requirements definition, and design trades
- Expectations of professional practice, communications, project management, and organizational skills
- Specific technical advice and help within their expertise, or leads in where to go to find the help you need.

The Faculty Guidelines can be found in [AES-SRP-002](#).

## 6.0 Grades

### 6.1 Grading Procedures

The requirements for each graded product in the course are specified in the corresponding assignment document. These are handed out in class and kept on the course web site. The grades are determined based on the criteria found there.

All grades are determined by the Project Advisory Board (PAB) as a whole, along with the Course Coordinator (CC).

### 6.2 Individual Grades versus Team Grades

#### 6.2.1 How are Grades Determined

Each student receives an individual grade. This grade is derived from the team grade given for each assignment. An individual's grade may be modified up or down from the team grade. This is done to reflect the performance of the individual student above or below the mean of the team. This performance is determined based on information from:

- Student Peer Reviews
- Notebooks and Weekly Time Sheets
- Project Advisors
- Project Staff

Successful projects require commitment from all team members.

#### 6.2.2 Criteria

Criteria for raising an individual's grade above the mean of the group include:

- Extraordinary innovation or technical achievement
- Extraordinary contribution in quality of effort
- Extraordinary leadership

Criteria for lowering an individual's grade below the mean of the group include:

- Sub-standard technical achievement

- Sub-standard contribution in quality of effort
- Sub-standard leadership

### 6.2.3 Feedback

The PAB will provide the student with specific rationale for their grade.

## 6.3 Grade Components

### 6.3.1 ASEN 4018

Product	Weight
Preliminary Design Review	30%
Critical Design Review	30%
Final Report	40%
<b>Total</b>	<b>100%</b>

### 6.3.2 ASEN 4028

Product	Weight
Interim Progress Review I	15%
ITLL Expo	15%
Final Presentation	30%
Final Report	40%
<b>Total</b>	<b>100%</b>

### 6.3.3 Notebooks and Weekly Time Sheets

Weekly time sheet reports for the period prior to a given review will contribute to the grade awarded for that review. Notebooks are also considered in grading (see Section 4.4).

### 6.3.4 Peer Reviews

Peer Reviews will be solicited from student team members at the time each graded product (presentation or report) is submitted. These Peer Reviews will be both for individuals in your team and reviews of other projects.

The Peer Reviews must be supported by specific examples consistent with the criteria given above in Section 6.2.2.

The PAB will give this information appropriate weight in grading.

### 6.3.5 Attendance

Attendance is required at all scheduled class meetings. Team attendance at all reviews is required, and will reflect in part on your team's grade for the given review.

### 6.3.6 Required Supplemental Material

Final Reports for each semester must be submitted along with

- a CD including all project documents (drawings, presentations, reports, analyses, models, etc)

- All team member Notebooks

## 6.4 Project Team Grades

Project grades are interpreted as follows:

Grade	Interpretation
A	Exemplary project overall. Specific highlights can be identified and enumerated.
B	Successful conception, design, fabrication, test and verification of the project with no major shortcomings or flaws.
C	Adequate project with some features of conception, design, fabrication, test and verification, but with multiple flaws.
D	Well below expected quality, with significant portions of conception, design, fabrication, test and/or verification missing or poorly attempted.
F	A failed project.

For the determination of a grade of A, “highlights” may include one or more of the following elements:

- Technical excellence in the conception, design, fabrication, test and/or verification of the project
- Solution of a technically complex problem
- Professionalism in the project development and/or execution
- Quality of presentation.

## 6.5 Incomplete Grades

Incomplete grades (IF) will not be given for ASEN 4028.

## 7.0 Project Formulation

### 7.1 Project Definition Document

Projects may be proposed by (1) a group of students, (2) faculty project customers, or (3) external project customers. This proposal will be made in the form of a Project Definition Document (PDD). Specifications for the PDD can be found in [AES-SRP-003](#).

Project customers, prospective student team members, and the PAB will collectively review and revise the PDD during the first two weeks of the Fall semester. Once all have agreed to the content of the PDD, the project is deemed approved and the team may proceed.

The PAB must approve the final PDD before project teams may proceed. The PAB reserves the right to disapprove unsatisfactory projects and to reassign prospective team members to other teams.

### 7.2 Expected Project Content

All projects are expected to:

- Conceive, design, fabricate, integrate, test and verify a product, device or system.
- Develop designs using quantitative, engineering analysis of appropriate complexity, reflecting the academic background expected of Aerospace Engineering seniors.
- Use standard engineering practices, including the development of requirements, specifications, drawings, schematics, verification plans, and test results.
- Use an appropriate set of professional project management tools and practices to ensure project progress, quality and timeliness.

### **7.3 Self-Paced Progress**

Students teams are encouraged to progress at their own pace. Due dates for reviews are the *latest* dates at which the review material must be submitted. Teams may begin major fabrication only after their Critical Design Review has been held and the PAB has granted Authority to Proceed.

PAB feedback and recommended actions will be provided soon after the presentation of a given review. However, all grades for a given review will be determined after all teams have made their presentations.

### **7.4 Multi-Year Projects**

Projects may build upon results obtained in previous years. Such projects have the advantage of involving students in overall projects with larger scopes than can be accomplished by one team in one year. Another advantage is that it introduces students to problems involving larger system level interactions and trades.

However, the project for a given year must be self contained. That is, it must lead to the development of a specific, new product, device or system, as required in Section 7.2. Multi-year projects must also define and maintain a set of higher level project goals and, as required, interface definition documents that define the boundaries for a given years activities.

### **7.5 Multi-Departmental Projects**

Projects may also be coordinated with seniors working in other departments on their own senior project class. This provides an opportunity for multi-departmental projects with an enhanced sophistication in specific disciplines.

However, a multi-departmental project will need to accommodate the necessary interfaces, both technical and academic, between the two departments. Students in such projects are responsible for drafting a plan to accommodate this issue. The PAB needs to approve this plan.