AME 502: Modern Topics in Aerospace Design

Course Syllabus

Fall Semester, 2014

Instructor: Jerry Lockenour
Department of Aerospace and Mechanical Engineering
Office: OHE 430M
Office Hours:
Tuesday: 2:00 pm to 5:00 pm
Thursday: 1:00 pm to 2:00 pm
Friday: 11:00 am to 1:00 pm
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Email: plocher@usc.edu

Course Background

The department of Aerospace and Mechanical Engineering desires to take advantage of the wealth of local aerospace industry by the direct involvement of local companies and other experts in this class. This class adds relevance to the curriculum content and helps to increase the student’s awareness of the challenges faced by contemporary aerospace development projects and in general adds to the richness of the student experience while it strengthens ties between the industry and the department.

Course Description

This is a 3 credit hour class for seniors, masters and doctorate students. The class consists of 3, one-day “Panel Discussion” sessions equally spaced throughout the semester. Each panel will consist of 4 invited experts on the selected topics from the aerospace industry or academia. Each panel session is followed by student team self-study projects based on the panel discussion topic. Prior to each panel discussion the student teams will be identified and the teams will be assigned a self-study topic directly related to the overall panel topic theme. The class will then meet weekly (for about three consecutive weeks) with one or more faculty members to review each teams progress and to discuss work-to-go for their project completion. The final meeting with the faculty will conclude with each student team making a presentation of their project results to the course instructor and submitting a final report. This
cycle will be completed three times throughout the semester—one for each of the three panel topics.

For the Fall 2014 semester the three panel topics will cover different regimes of flight. Panel 1) Advanced Vertical Takeoff & Landing (VTOL) Concepts—covering such vehicles as X-Wing Stopped Rotors, ROTORwing, Boeing Phantom Swift, Arcturus Quadrotors, Aerovel Flexrotor… Panel 2) Electric Flight Vehicles—including all solar-electric and larger turbo-electric concepts, QinetiQ Zephyr, DARPA Vulture….., and Panel 3) Personal Air Vehicles—including everything from the flight (gliding) suits to the Glenn Martin JetPack and the Terrafugia and CarCraft convertible car-planes ….. The assigned self-study topics will cover a wide range of disciplines including configuration design, aerodynamics, structures, propulsion and flight controls.

Learning Objectives

The essence of this course is to prepare the student for a career in the aerospace industry by learning to:
1) work on assigned technical projects as part of a team,
2) conduct independent research on topics of contemporary relevance to the aerospace industry,
3) interact with key industry technical experts on their assigned self-study topics,
4) evaluate the state-of-the-art of the existing research, evaluate the pros and cons of competing approaches and propose preferred or new solutions, and
5) effectively communicate the results of the work in both verbal/briefing chart form and in a final technical report.

Recommended Preparation: This class is open to seniors, masters and doctoral students with a strong interest in the aerospace industry. These are no prerequisites or or co-requisites. But it is recommended that the student’s have a strong background in the following areas:

• AME 441 Senior Project, or equivalent
• AME 481 Design, or equivalent
• Student interest in overall aerospace vehicle design

Course Notes

Course Website: This course is supplemented by use of the USC Blackboard instruction system (https://blackboard.usc.edu/). All registered students have access to this website and should go to AME 502. The course website structure is implemented to support the specific organization of the course instruction as described in this syllabus. All students should browse around the entire site to familiarize themselves with various areas and functions of this course website.

• Announcements -- important announcements of this course.
• Syllabus – contains an up to date copy of the class syllabus.
• Content – pdf copies of panel discussion slides presented by the industry guests.
• Discussions – a place for the students to share their thoughts about interesting subjects with the class.
• Groups -- Each team will be assigned a “Group” section in which they can share data, files and jointly build their briefings and final reports.
• Websites – links to reference material.

**Class Hours and Locations:**
The first class of the semester (Aug 29th) in RRB 2nd floor, Laufer Library. Industry Panel Discussion Days—on 3 days during the semester the class will meet with an industry panel of technical experts from 10:00 am to 3:00 pm in EEB 248.

- Panel #1— Advanced VTOL Concepts Friday, 5 Sept
- Panel #2— Electric Flight Friday, 10 Oct
- Panel #3— Personal Air Vehicles Friday, 7 Nov

On the weeks following each panel discussion the class will meet from 1:00 to 3:00 pm in RRB 2nd floor Laufer Library.

**Technological Proficiency and Hardware/Software Required**

The course will require the use of briefings projecting material for the audience involving the use of Microsoft Power Point or some like tool. The self-study research may on occasion involve engineering analysis or trade studies. The three final briefings at the conclusion of each of the topic research sections will be presented via WebEx so that the industry panelists will be able to view and comment on each teams briefing. IT support will be provided by AME IT specialist Dennis Plocher, 213-740-7190, plocher@usc.edu.

**Required Reading and Supplementary Materials**

**Required Textbook:** No textbook is required to be purchased by the students.

**Literature Search:** Extensive literature research will be required as part of the team self-study projects. The industry panel members and the instructor may recommend additional reading materials and website reference resources during the semester.

**Department Provided Reference Books:** Three reference textbooks will be furnished to each team by the AME department.

1) Fundamentals of Aircraft & Airship Design, Volume 1, Aircraft Design, Leland Nicolai and Grant Carichner
2) Fundamentals of Aircraft & Airship Design, Volume 2, Airship Design and Case Studies, Leland Nicolai and Grant Carichner
2) Future Aeronautical and Space Systems, Ahmed K. Noor and Samuel L. Venneri

**Description and Assessment of Assignments**

Students’ learning experience in this course will come from three (3) interrelated components:
**Participation in Panel Discussions:** Each panel will consist of 4 invited experts on the selected topics from the aerospace industry or academia. These will be interactive sessions. The students are expected to be active participants—asking questions and adding to the exchange.

**Classroom Activity Following Each Panel Session:** The class will meet each Friday following the panel sessions to discuss their team progress on their self-study topics. In these sessions the instructor along with other faculty knowledgeable of the topic will review and advise the student teams on their respective self-study projects.

**Conclusion of Team Self-Study—Final Report and Briefing:** At the end of each of the three self-study projects the student teams will deliver a final report on their assigned topic and give a briefing on their findings.

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### Grading Breakdown

Students will be graded according to the following scheme:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom/Panel Discussion</td>
<td>10%</td>
</tr>
<tr>
<td>Panel #1 Team Final Report</td>
<td>15%</td>
</tr>
<tr>
<td>Panel #1 Team Briefing</td>
<td>10%</td>
</tr>
<tr>
<td>Panel #2 Team Final Report</td>
<td>15%</td>
</tr>
<tr>
<td>Panel #2 Team Briefing</td>
<td>10%</td>
</tr>
<tr>
<td>Panel #3 Team Final Report</td>
<td>15%</td>
</tr>
<tr>
<td>Panel #3 Team Briefing</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>15%</td>
</tr>
</tbody>
</table>

Each of the above grading components is described in more details below.

### Grading Components:

**Classroom/Panel Participation (10%)**

The students are expected to attend all panel discussions, attend the classroom sessions in between each panel discussion. Active participation in all is expected.

**Team Final Reports (total of 3, 45%)**

A total of three final reports will be prepared, one for each of the three topics. Each report will constitute 15% of the student’s semester grade. The reports must document the results of the team self-study and include references to their major sources. The final reports will be a team product; however, sections within the report will identify the individual team member who authored that section. On that basis there will be an overall team report grade and an individual grade.

**Team Final Briefings (total of 3, 30%)**

Each of the three self-study periods will conclude with the team presenting to selected faculty the results/conclusions of their ~ month long study. Each briefing will consist of a 20-minute presentation. Each briefing will constitute 10% of the student’s semester grade. The briefings will highlight the key findings on their assigned sub-topics. Each team member will present a portion of the briefing. On that basis there will be an overall team report grade and an individual grade.

**Final Exam (15%)**
The final will consist of the submission of individual reports by each student. This is not a normal final exam. During finals week each student will submit a final report and have a 15-minute conference with the faculty team. This will relate to the overall class experience. This report will be in three parts. First—a technical section on what were the key things that each student learned from the class. Secondly—a critique of what each student thought were the key strengths (things that should be continued or strengthened) and the weaknesses— with suggestions on how to improve the program. Third—the faculty will present a list of potential new/different topics for the next class on which the students can vote or add their own suggested topics.

**Schedule Performance to Plan**

This course must hold to the overall semester schedule. The panel discussions involve the scheduling of industry experts to participate on the noted dates. It is very important that students attend these panel discussions. Also the team briefings at the end of each self-study period again involve the gathering of the industry experts and selected faculty and must be held on the noted dates, because the next class following the briefings we proceed to the next panel discussion topic.

**Academic Integrity**

The Viterbi School of Engineering adheres to the University's policies and procedures governing academic integrity as described in SCampus. Students are expected to be aware of and to observe the academic integrity standards described in SCampus, and to expect those standards to be enforced in this course.

**Students with Disabilities**

Any Student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.
Course Schedule: A Weekly Breakdown

*The Instructor reserves the right to change this schedule and topics during the semester:*

<table>
<thead>
<tr>
<th>Week No</th>
<th>Date</th>
<th>Class Subject</th>
<th>Reading &amp; Homework</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/29</td>
<td>Introduction to the Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overview of Class Expectations</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>9/5</td>
<td><strong>Panel #1</strong> Advanced VTOL Concepts</td>
<td>Prepare by initiating research on assigned subtopic</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>10 am to 3 pm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9/12</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9/19</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9/26</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10/3</td>
<td><strong>Submit Team Self-Study Report and Briefing</strong></td>
<td></td>
<td>Submit Subtopic #1 Final Report and Team Briefing</td>
</tr>
<tr>
<td>7</td>
<td>10/10</td>
<td><strong>Panel #2</strong> Electric Flight</td>
<td>Prepare by initiating research on assigned subtopic</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>10 am to 3 pm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>10/17</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10/24</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10/31</td>
<td><strong>Submit Team Self-Study Report and Briefing</strong></td>
<td></td>
<td>Submit Subtopic #2 Final Report and Team Briefing</td>
</tr>
<tr>
<td>11</td>
<td>11/7</td>
<td><strong>Panel #3</strong> Personal Air Vehicles</td>
<td>Prepare by initiating research on assigned subtopic</td>
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<tr>
<td></td>
<td></td>
<td><strong>10 am to 3 p</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>11/14</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
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<tr>
<td>13</td>
<td>11/21</td>
<td>Team Status</td>
<td>Research on assigned subtopic</td>
<td></td>
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<tr>
<td>14</td>
<td>11/28</td>
<td>Thanksgiving Holiday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>12/5</td>
<td><strong>Submit Team Self-Study Report and Briefing</strong></td>
<td></td>
<td>Submit Subtopic #3 Final Report and Team Briefing</td>
</tr>
<tr>
<td>16</td>
<td>12/12</td>
<td><strong>Final Exam</strong>—submitted report—see syllabus</td>
<td></td>
<td>Submit written report—see syllabus</td>
</tr>
</tbody>
</table>