

MAE 695-01,-91,-92, -93

Advanced Solid Rocket Propulsion

3 hours credit

<p>Instructor: Robert A. Frederick, Jr., Ph.D. Professor MAE Interim Director, UAH Propulsion Research Center Tech. Hall, S226, Huntsville, AL 35899 Phone 256-824-7200; FAX: 256-824-7205 Email: Robert.Frederick@uah.edu Office Hours: Tuesday 8:30 – 11:00 AM</p>	<p>Section 01 – Conventional Class Section 91/93/93 – Web Delivered Dist. Learning (DL) Class Location: UAH Tech. Hall Room N142 Class Time: Friday 9:10 – 11:15 AM DL Information – Dottie Luke, 256-824-6976</p>
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TEXT:

- Rocket Propulsion Elements, 7th Edition, G.P. Sutton, ISBN 0-471-32642-9
- Recommended: McDonald, A.J., Truth, Lies, and O-Rings (ISBN 978-0-8130-3326-6), University of Florida Press.
- Course Charts, Videos, and Transcripts (online)

OBJECTIVES:

- Acquire and demonstrate knowledge of solid rocket propulsion facts.
- Demonstrate knowledge of solid propulsion principles.
- Demonstrate understanding of the literature in one technical topic

SCOPE:

Fundamental Concepts from Design to Manufacture and Test

APPROACH:

- Guest Lectures by Highly-Experienced Experts from the Solid Rocket Community
- Lecture Quiz on each Guest Lecture
- Basic Homework Problems
- Project

THE GRADE

The final grade is based on the following formula:

- Course Grade = 50% Lecture Quizzes + 25% Homework + 25% Project Report
 $A \geq 90.0$; $B \geq 80.0$; $C \geq 70.0$; $D \geq 60.0$; $F < 60.0$

WEB ACCESS TO COURSE MATERIALS:

Access to course materials is through an internet learning system called ANGEL. The course page can be assessed at

<https://angel.uah.edu> in the

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course. With ANGEL, you will take quizzes, send and receive course mail, post to threaded discussions and chat rooms, upload assignments using drop-boxes, and more. Students can check their progress and grades at any time during the course and can create groups and teams for project work.

LECTURES/GUEST LECTURES:

The live lectures each week will be made available to distance learning students only. On campus students are expected to attend class to receive this material live. The Guest Lectures (each of which is 2-3 hours long) will be made available to both on-campus and distance learning students as a required resource. The quizzes are based on the guest Lectures. The instructor will provide the on-campus class with a URL, login, and password to view the Guest Lectures on the ISE Distance Learning Website. The Distance Learning Office will provide Distance Learning Students with an individual login to access to the video of each current class discussion and the pre-recorded guest lectures.

QUIZZES:

A multiple-choice quiz will be given on each lecture and assigned textbook reading via the internet (ANGEL). The quiz will cover material presented in the speaker's charts and comments made by the speaker during the lecture. You will have two attempts at each quiz, and the score on your latest attempt will be entered into the grade book (i.e. if second score is lower, it is the one recorded). The due dates for each quiz assignment are shown in this syllabus and on ANGEL.

HOMEWORK:

Each homework assignment will be posted electronically on ANGEL and must be submitted electronically via an ANGEL Homework Drop box. The due dates for each homework assignment are shown in this syllabus and on ANGEL. Late homework will not be graded and will not receive credit. You may drop one homework assignment.

Selected homework assignments will include making an annotated bibliography of references cited in the Guest Lecture. The Annotated Bibliography has a very specific format and the instructions are attached to this syllabus.

CLASS PROJECT:

The project will involve application of the presented materials and student-researched materials. In-Class and DL students will be paired to focus on one or two of the lectures. The project will be documented by a written report authored by the student team. Barring unusual circumstances, all authors on a given project report will receive the same grade. Each team will give a brief oral presentation of their final report. DL students will telecome to class for presentation. The class project assignment will be posted in ANGEL.

Assignment Sheet - MAE 695 – Advanced Solid Rocket Propulsion

Date	Topic	Name	Comp.	Lecture Quiz and HW Due 10:00 PM
1/15/2010	Session 1: Solid Rocket Motor Overview Assigned Reading: Sutton Chapter 1 and 2 HW01 – Assignment Posted by Instructor and Submitted in ANGEL	Bob Geisler	Cons.	1/25/2010
1/22/2010	Session 2: Solid Rocket Motor Design Assigned Reading: Sutton Chapter 3:1, 3;2, 3:3, and Ch. 14 HW02 – Assignment Posted by Instructor and Submitted in ANGEL	Dan Meyer	Aerojet	2/01/2010
1/29/2010	Session 3: Ballistic Modeling & Burn Rate Analysis Assigned Reading: Sutton Chapter 13 HW 03 – Assignment Posted by Instructor and Submitted in ANGEL	Sam Schlueter	Aerojet	2/08/2010
2/5/2010	Session 4: Propellant Fundamentals Assigned Reading: Sutton Chapter 12 HW 04 – Assignment Posted by Instructor and Submitted in ANGEL	Carol Campbell	ATK	2/15/10
2/12/2010	Session 5: Combustion & Two-Phase Flow Assigned Reading: Sutton Chapter 5 HW 05 – Assignment Posted by Instructor and Submitted in ANGEL	The late Jim Kliegel	Cons.	2/22/2010
2/19/2010	Session 6: Propellant Grain Design Assigned Reading: Sutton Chapter 11:3, 11;4 HW 06 – Assignment Posted by Instructor and Submitted in ANGEL	McKay Anderson	Cons.	3/01/2010
2/26/2010	Session 7: Motor Case Design Assigned Reading: Sutton Chapter 14:1, and 14.2 HW 07 – Assignment Posted by Instructor and Submitted in ANGEL	Hugh Reynolds	Cons.	3/08/2010

Assignment Sheet - MAE 695 – Advanced Solid Rocket Propulsion

Date	Topic	Name	Company	Lecture Quiz and HW Due 10:00 PM
3/05/2010	Session 8: Thermal Protection & Insulation Assigned Reading: Sutton Chapter 12.6 HW 08 – Assignment Posted by Instructor and Submitted in ANGEL	Joe Koo	Cons.	3/15/2010
3/12/2010	Session 9: Nozzle Design Assigned Reading: Sutton Chapter 3:4; 3:5, 3:6, 3:7, 3:8 and 14.2 HW 09 – Assignment Posted by Instructor and Submitted in ANGEL	Russ Ellis	Cons.	3/22/2010
3/26/2010	Session 10: Igniter Design Assigned Reading: Sutton Chapter 13 HW 10 – Assignment Posted by Instructor and Submitted in ANGEL	Rob Black	Aerojet	4/05/2010
4/2/2010	Session 11: Motor Manufacturing /ITAR Assigned Reading: Sutton Chapter 12:7 HW 11 – Assignment Posted by Instructor and Submitted in ANGEL	Dave McGrath	ATK	4/12/2010
4/9/2010	Session 12: Motor Demo and Performance Assigned Reading: Sutton Chapter. 20 HW 12 – Assignment Posted by Instructor and Submitted in ANGEL	Paul Willoughby	Cons.	4/19/2010
4/16/2010	Session 13: System Engineering & Trades Assigned Reading: Sutton Chapter 14.4 and Chap. 17 HW 13 – Assignment Posted by Instructor and Submitted in ANGEL	Ed Casillas	Aerojet	4/26/2010
4/23/2010	Session 14: Solid Rocket Motor Failure Assigned Reading: Sutton Chapter 20.5 HW 14 – Assignment Posted by Instructor and Submitted in ANGEL	Allan McDonald	Cons.	4/29/2010
4/29/2010	Session 15: Project Presentations (Final) 8:30 AM – 10:30 AM CST.	Frederick	UAH	4/30/2010 8:30 – 10:30

Two-Page Annotated Bibliography Template

Comment [RAF1]: Compile all of your annotated bibliographies into one Word Document

A. Summarize

Reference Document Examined:	Hulka, J. R., "Scaling of Performance in Liquid Propellant Rocket Engine Combustion Devices," AIAA Paper 2008-5113, July 2008.
Reviewer:	Your Name
Source of Document:	
Copyright Information:	
Date of Review:	
Keywords:	
Electronic File Name:	

Comment [RAF2]: List the complete citation of the reference here. Use the AIAA Journal reference format. – <http://www.writetrack.net/aiaa/documents/ReferenceFormat.pdf>

Comment [RAF3]: List the source of the document (online, company, particular library, particular website, and any copyright information.

Comment [RAF4]: List keywords that describe the paper. Separate keywords by commas

Comment [RAF5]: List name of electronic file.

Summary:

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B. Assess:

Important Facts from Document:

- 1.
- 2.
- 3.
- 4.
- 5.

Comment [RAF6]: Type in your one-page summary, single space, here. This paragraph or set of paragraphs should at least complete the first page. You may include one picture (not to exceed ½ pages) in the summary.

Comment [RAF7]: List five important facts you learned from the reference document you examined. Put them in the form of complete sentences.

Important Relationships Among Parameters Described in the Paper:

- 1.
- 2.

Comment [RAF8]: List 2 important relationships among parameters that are described in the paper. For example, when the pressure in the chamber goes up, the specific impulse increases; or, when a supplier goes out of business, the rocket community must turn to commercial industries that have a larger market to sustain the products. This could also be an important equation that shows the relationships among the facts.

Important Conclusion(s):

- 1.
- 2.

Comment [RAF9]: List at least two conclusions from the paper most relevant to your current interests/project in propulsion – Remove instructions from submission.

F. Reflect

Comment [RAF10]: "Once you've summarized and assessed a source, you need to ask how it fits into your research. Was this source helpful to you? How does it help you shape your argument? How can you use this source in your research project? Has it changed how you think about your topic?"

Basic Project Instructions

Your project will focus on one of the lectures in the class. You will participate with one other student in the class on your project. Distance learning students will be paired with an on campus student.

For In Homework number 1, you will submit a proposal with your first three choices of topics (By lecture # and title).

The project will consist of at least the following:

1. A 5,000 word chapter, in the style of a textbook (like Sutton) on Guest Lecture of your Topic.
2. An oral presentation on that summarizes your findings and lessons learned about Advanced Solid Rocket Propulsion.
3. Annotated bibliography on 10 papers from the Guest Lecture of your Topic
4. Annotated bibliography of 10 related paper not in the Guest Lecture of your Topic
5. Final cleanup of transcript of the Guest Lecture of your Topic.
6. Two example problems and solutions on topics related to the Guest Lecture of your Topic.
7. A table of charts from other lectures in the class that are very relevant to your topic (i.e. material could be moved into this topic)