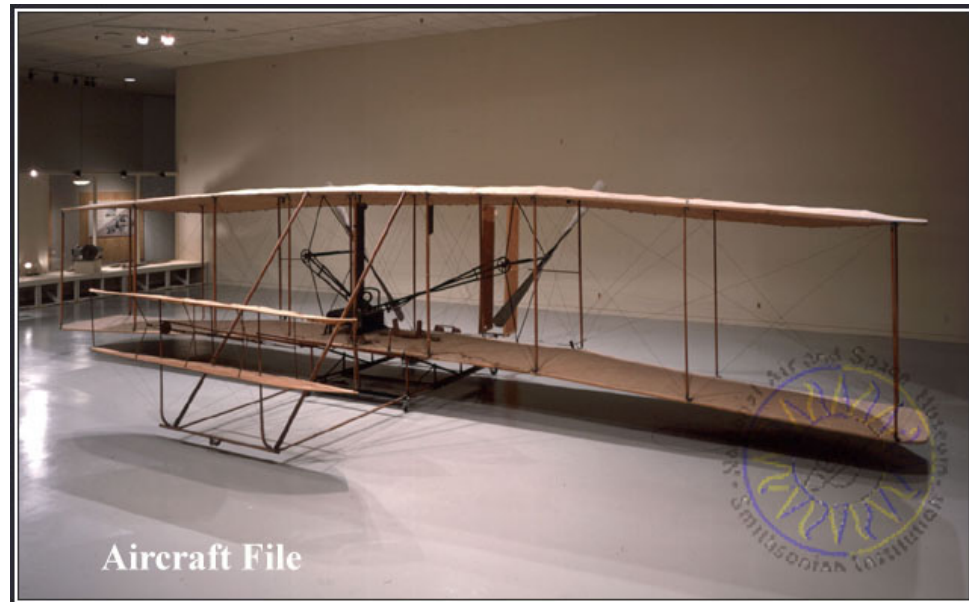


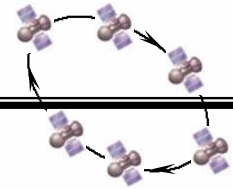
Introduction to Aerospace Engineering

- Course description:
An overview of aerospace engineering from a design perspective; introductory aerodynamics, lift, drag, and the standard atmosphere; aircraft performance, stability, and control; propulsion; structures; rocket and spacecraft trajectories and orbits.

- Randolph 120
11:00 – 12:15 Tu Th

- Professor C. D. Hall
Randolph 224D
231-2314
cdhall@vt.edu





- What is Aerospace Engineering? (Notes)
- History (Chapter 1 & Notes)
- Fundamental Thoughts (Chapter 2 & Notes)
- Atmosphere and Aerodynamics (Chapters 3 & 4)
- Aircraft Motion (Chapters 5, 6, & 7)
- Spacecraft Motion (Chapter 8 & Notes)
- Propulsion (Chapter 9 & Notes)
- Power (Chapter 6)



Reading Assignment: §§ 8.13, 8.14 and Chapter 1

Grading Policy:	Homework	15% (includes daily quizzes)
	Essays (3)	15%
	Midterm I	20%
	Midterm II	20%
	Final	25%
	Wild Card	5%
	Vehicle	2 points extra



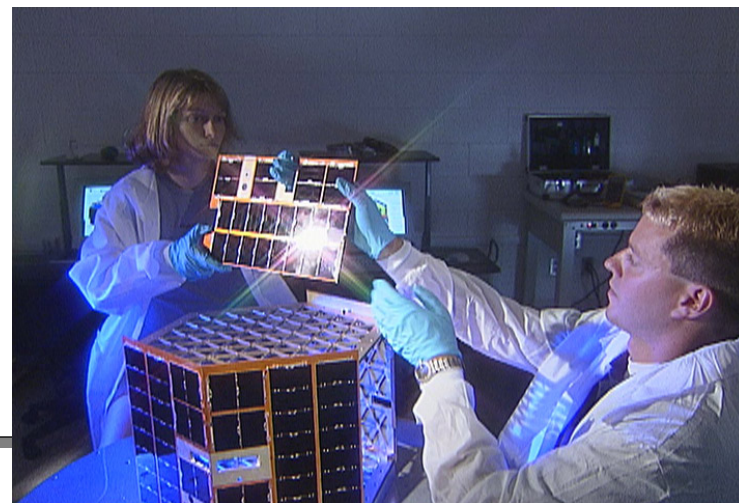
What Is Aerospace Engineering?

- What do Aerospace Engineers do?
- How do they do it?
- What tools do they use?
- What knowledge do they need?
- How do they learn that knowledge?
- Who do they work with?
- Where do they go to work?
- How does what they do benefit society?
- What are some current AE systems?
- Do AEs need to go to Graduate School?

Graduating engineers should be able to

- Conceive
- Design
- Implement
- Operate

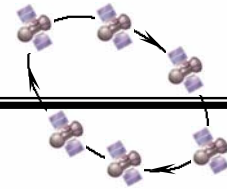
complex value-added engineering systems in a modern team-based environment



Boeing's Desired Attributes of an Engineer

- a. A good understanding of engineering science fundamentals: Mathematics (including statistics), Physical and life sciences, Information Technology (far more than “computer literacy”)
- b. A good understanding of design and manufacturing processes
- c. A multi-disciplinary *systems* perspective
- d. A basic understanding of the *context* in which engineering is practiced: Economics, History, the environment, customer and societal needs
- e. Good communication skills: written, verbal, graphic and listening
- f. High ethical standards
- g. An ability to think both critically and creatively – independently and cooperatively
- h. Flexibility. The ability and self-confidence to adapt to rapid or major change
- i. Curiosity and a desire to learn for life
- j. A profound understanding of the importance of teamwork

Another View of Desired Attributes of an Engineer

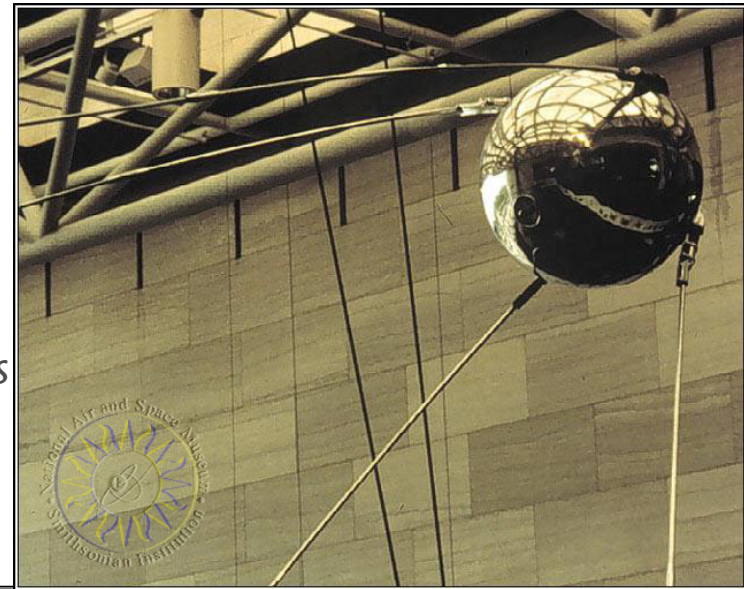


- 1.1. Knowledge of underlying sciences
- 1.2. Core engineering fundamental knowledge
- 1.3. Advanced engineering fundamental knowledge

- 2.1. Engineering reasoning and problem solving
- 2.2. Experimentation and knowledge discovery
- 2.3. System thinking
- 2.4. Personal skills and attitudes
- 2.5. Professional skills and attitudes

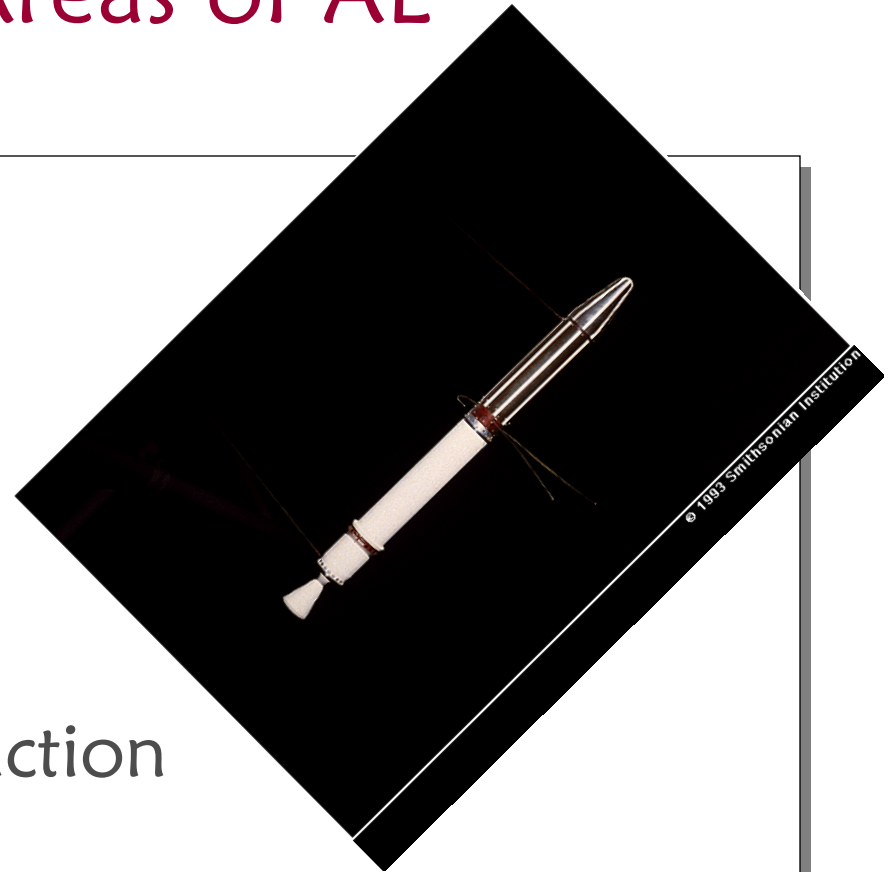
- 3.1. Teamwork
- 3.2. Communication

- 4.1. External and societal context
- 4.2. Enterprise and business context
- 4.3. Conceiving and engineering systems
- 4.4. Designing
- 4.5. Implementing
- 4.6. Operating



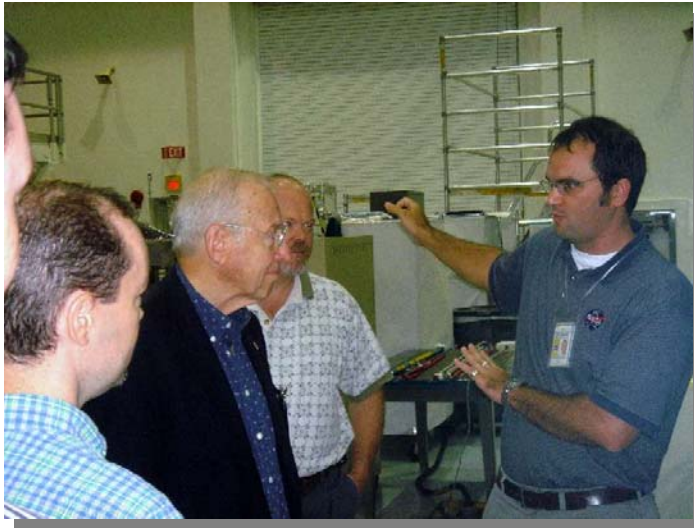
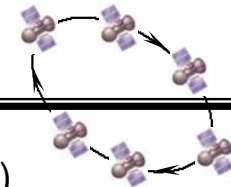
Technical Areas of AE

- Fluid mechanics
- Solid mechanics
- Dynamics and control
- Instrumentation
- Automation
- Human-machine interaction
- Propulsion
- Aircraft, Spacecraft, and Rockets



Aerospace Engineers ...

- Conceive, Design, Develop, Test, Manufacture, Operate, Maintain, Market, Sell, Manage *Aerospace Vehicles and Related Systems and Subsystems*
- Work for small and large aerospace companies, in academia, in government, in other industries, on Wall Street
- Go on to graduate school in engineering, science, business, law, medicine, ...
- Create new companies to exploit advancing technologies
- ?



Aerospace Engineering (May 2001)
Operations Engineer, NASA Kennedy Space
Center Shuttle Payloads and International Space
Station Processing Directorate

Duties: I'm currently assigned as an operations engineer for the outboard truss power modules of the ISS, which are being readied for flight in the Kennedy Space Center Space Station Processing Facility. Operations engineer is a fancy word for "assistant project manager" for the ground processing of the ISS Elements that I'm assigned to. Go to <http://www.spaceflight.nasa.gov/shuttle/future/index.html> and check out the links to the 12A, 13A, and 15A assembly flights to see the space station hardware I'm working on. And visit <http://www.spaceflight.nasa.gov/realdata/ksclive/index.html> to see video feeds of the SSPF (I think channels 5, 6, and 9 are from my facility).

These pictures are from when Apollo astronaut Jim Lovell toured the SSPF high bay. I had the opportunity to meet him and talk to him about the space station elements I'm working on, as well as his experience with Apollo 13.

B.S. '00, M.S. '02, Aerospace Engineer, NASA Goddard Space Flight Center
Code 542/Mechanical Systems Analysis & Simulation Branch

Job Description:

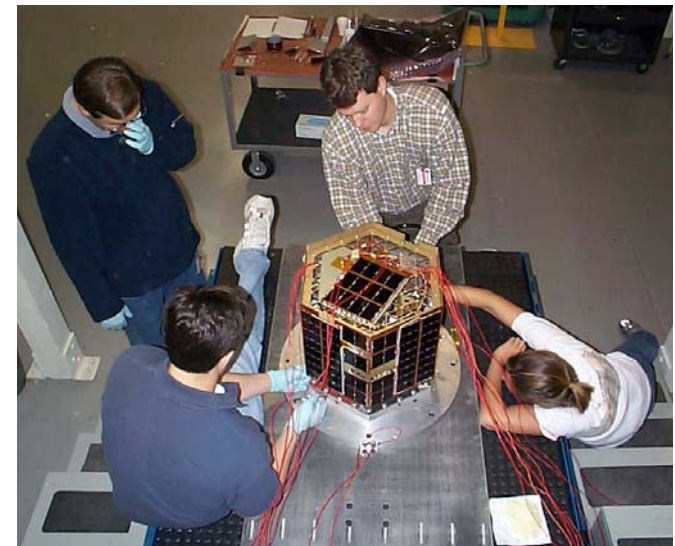
Perform all aspects of spacecraft structural analysis and testing. Assist designers with sizing and optimization of components. Development of precision optical assemblies for space applications. Derive loads in structure due to acoustic, random vibration, and sine vibration loading. Coupled loads analysis (CLA) of spacecraft and launch vehicle in launch environment. Vibration testing of spacecraft and spacecraft components to verify integrity during mission.

Projects:

- Mercury Laser Altimeter (MLA): MESSENGER
- SWIFT: Test and Analysis Correlation
- STS Return to Flight: Fatigue Life Analysis of LH₂ Flowliner
- LEISA: Pluto New Horizons Instrument
- GPM: (Global Precipitation Measurement) mission with JAXA (Japan)

Required Skills: Programming: C++, MATLAB, Perl

- FEA: FEMAP, NASTRAN; Reports: MS Word, Excel



Sophomore Year

FALL				SPRING			
AOE	2074	COMP METHODS	3	AOE	3094	AOE MATERIALS	3
AOE	2104	INTRO AERO ENGR	3	AOE	3104	AIRCRAFT PERFORMANCE	3*
ESM	2104	STATICS	3	ESM	2204	MECH DEFORM BODIES	3
MATH	2224	MULTI VAR CALC	3	ESM	2304	DYNAMICS	3
PHYS	2306	PHYSICS II	4	MATH	2214	DIFFERENTIAL EQUATIONS	3
ELECTIVE**			1	ELECTIVE**			3
			17				18

Junior Year

FALL				SPRING			
AOE	3014	AERO/HYDRO-DYNAMICS	3	AOE	3054	EXPER. METHODS	3
AOE	3024	THIN-WALL STRUCTURES	3	AOE	3114	COMPRES. AERO-DYNAMICS	3
AOE	3034	VEH. VIB & CONTROL	3	AOE	3124	AERO STRUCTURES	3
MATH	4564	OPER METH FOR ENGR	3	AOE	3134	STABIL & CONTROL	3
ME	3134	FUND OF THERMODYN	3			OR	3
ELECTIVE**			3	AOE 4140	SPACECRAFT DYN & CONT.		
			18	MATH ELECTIVE+			3
				ELECTIVE**			3
							18

Senior Year

FALL				SPRING			
AOE	3044	BOUND LAYER & HEAT TR	3	AOE	4066	DESIGN II *** (WI)	3
AOE	4065	DESIGN I *** (WI)	3	ELECTIVES**			6
AOE	4134	ASTROMECHANICS	3	TECHNICAL ELECTIVES++			6
AOE	4154	AERO ENGR LABORATORY	1				15
AOE	4234	AERO PROPULSION	3				
TECHNICAL ELECTIVES++			3				
			16				

Note: There is a choice between Aircraft and Spacecraft Design.
 To take Spacecraft Design, you must take AOE 4134 and AOE 4140
 in Junior Year.

Next Time

Reading Assignment:
§§ 8.13, 8.14 and Chapter 1

- Quiz **Bring 3x5 cards**
- Finish discussing aerospace engineering
- Begin discussion of relevant history

