## Aero 526: Hypersonic Aerothermodynamics

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<tr>
<th>COURSE #: 526</th>
<th>COURSE TITLE: HYPERSONIC AEROTHERMODYNAMICS</th>
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<td>TERMS OFFERED: Fall</td>
<td>PREREQUISITES: Grad Standing, or Aero 225 and Aero 325</td>
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<td>INSTRUCTOR(S): Boyd</td>
<td>SCIENCE/DESIGN CREDITS: 3/0 (elective course)</td>
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### CATALOG DESCRIPTION:
Hypersonic vehicles offer rapid air transportation and access to space. This course provides an introduction to the aerothermodynamics of hypersonic vehicles. Topics covered include: vehicle types (missiles, space planes, air-breathers); flight dynamics (trajectory, range, stability); aerothermodynamics (fluid dynamics, thermodynamics, aerodynamics, heating); and propulsion systems (scramjets, combined cycles).

### COURSE TOPICS:
- Hypersonic vehicle types.
- Hypersonic vehicle trajectories.
- Shock wave analysis.
- Real gas effects.
- Stagnation point analysis.
- Pressure distribution.
- Heat transfer and skin friction distribution.
- Hypersonic propulsion systems.

### COURSE OBJECTIVES
1. Review the missions of different hypersonic vehicles.
2. Introduce students to the trajectories followed by different hypersonic vehicles.
3. Study the environment around hypersonic vehicles created by strong shock waves.
4. Introduce students to real gas effects caused by high temperature conditions.
5. Study pressure and heat transfer phenomena at the stagnation point of a hypersonic vehicle.
6. Study the distribution of pressure around a general vehicle shape.
7. Study the distribution of heat transfer and skin friction around a general vehicle shape.
8. Review hypersonic propulsion options based on rocket, turbine, and ram/scramjet technology.

### COURSE OUTCOMES
On completion of Aero 526, students can:
1. Analyze the trajectories of ballistic missiles, space planes, and air-breathing hypersonic vehicles.
2. Perform perfect and real gas analyses of shock waves.
3. Have a basic understanding of real gas effects such as vibrational activation, dissociation, ionization, and molecular transport phenomena.
4. Determine the stagnation properties of a hypersonic vehicle.
5. Determine profiles of pressure, skin friction, and heat transfer around a vehicle.
6. Have a basic understanding of hypersonic propulsion options including combined cycle technologies.

### ASSESSMENT TOOLS
1. Written homework assignments.
2. Mid-term exam.
3. Final exam

New course approved by Aero faculty: January 31, 2003