Solving Hypersonic Flow Problems

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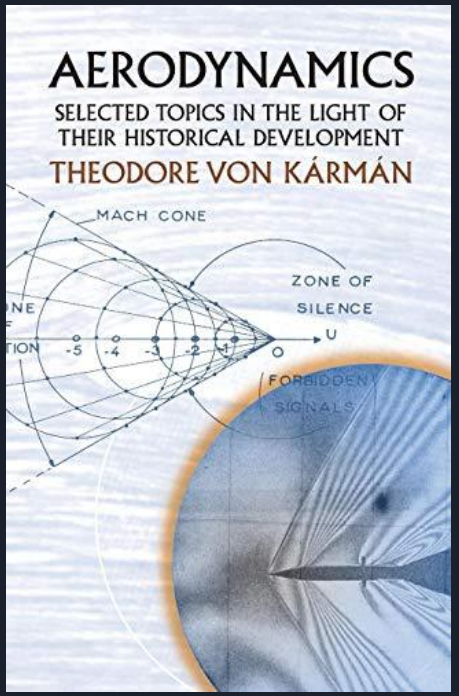
General Overview

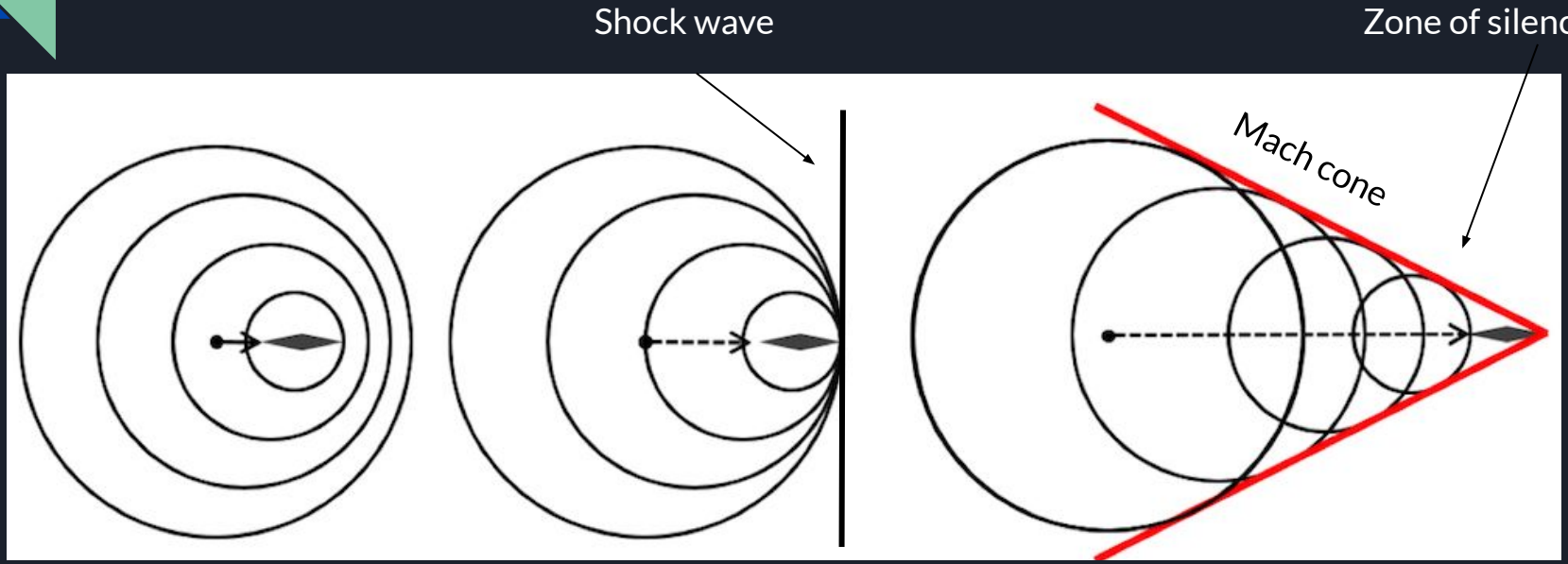
- June 8 - July 31
  - 3 weeks research
  - 2 weeks Capstone
  - 3 weeks Paraview
- 100% virtual
  - Zoom meetings 3 times a week at 10:30
- University of Maryland at College Park
  - Department of Aerospace Engineering
- Using varying softwares to visualize and study hypersonic flow problems

Background

- Mach number → ratio of the speed of the body to the speed of sound in the surrounding medium
- Subsonic < speed of sound < supersonic
    - Hypersonic ~ Mach number of 10 or great

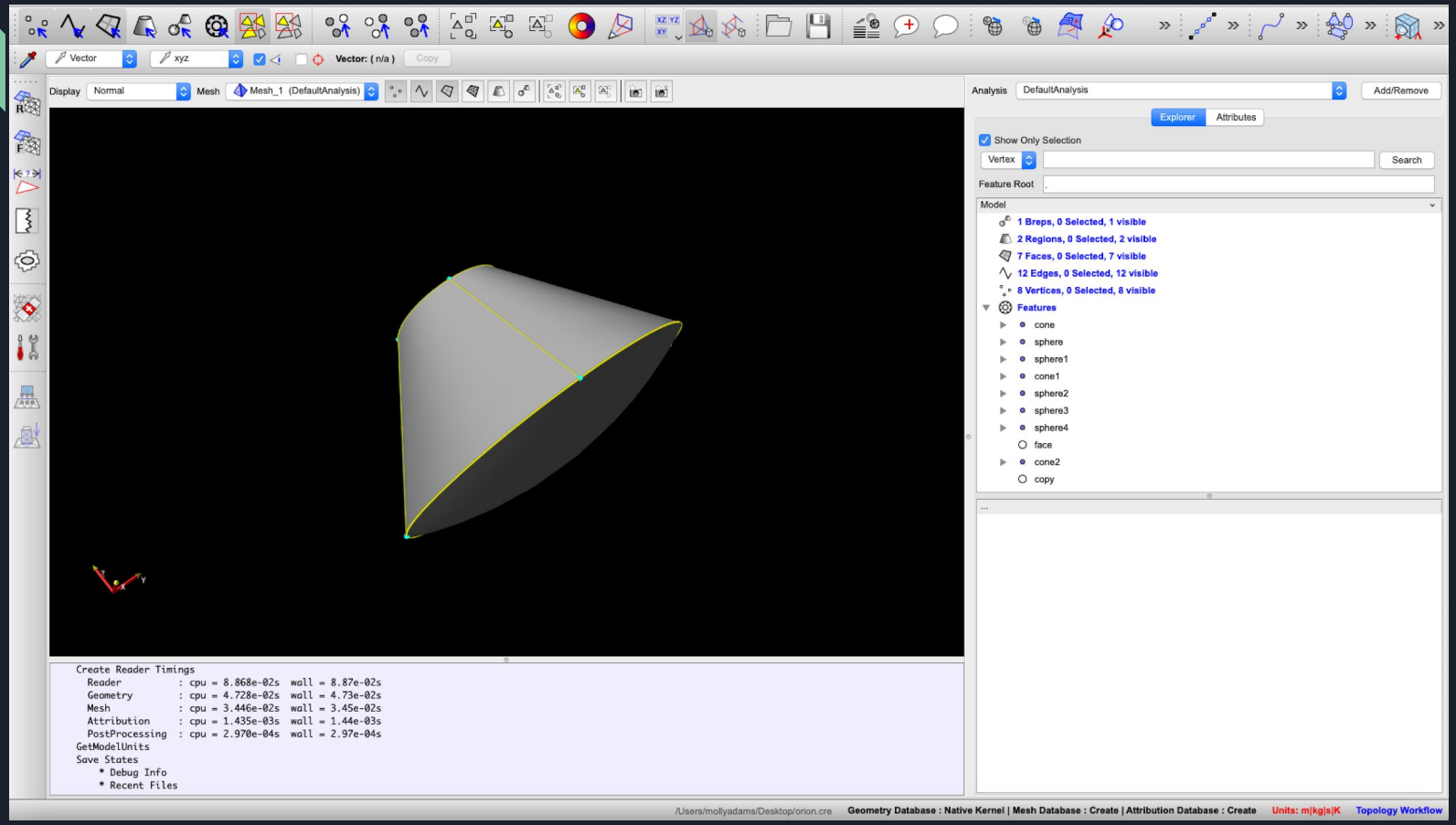


Supersonic Flow



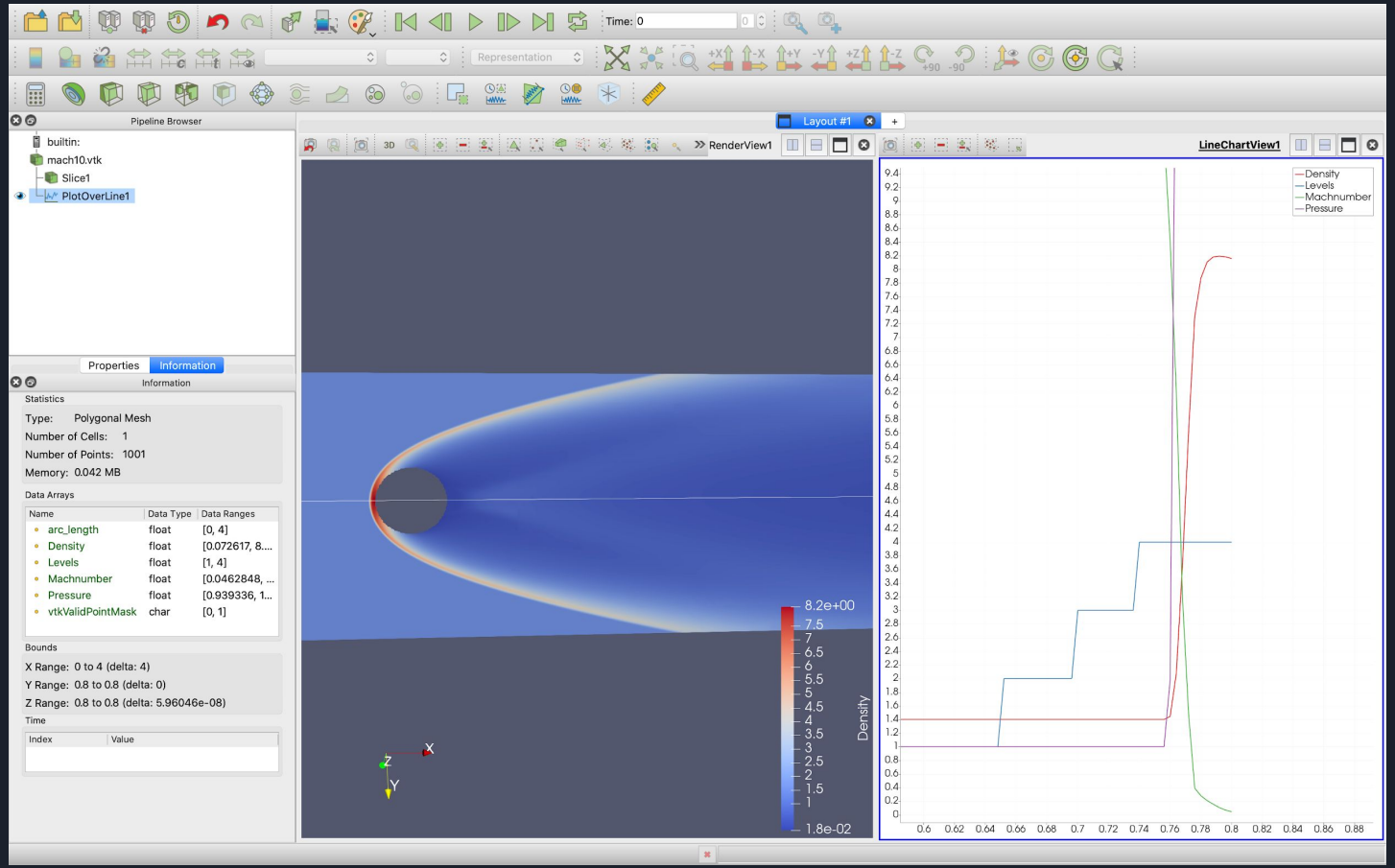
Capstone

Software to make geometry and mesh



Paraview

Software to visualize the effects of hypersonic flow



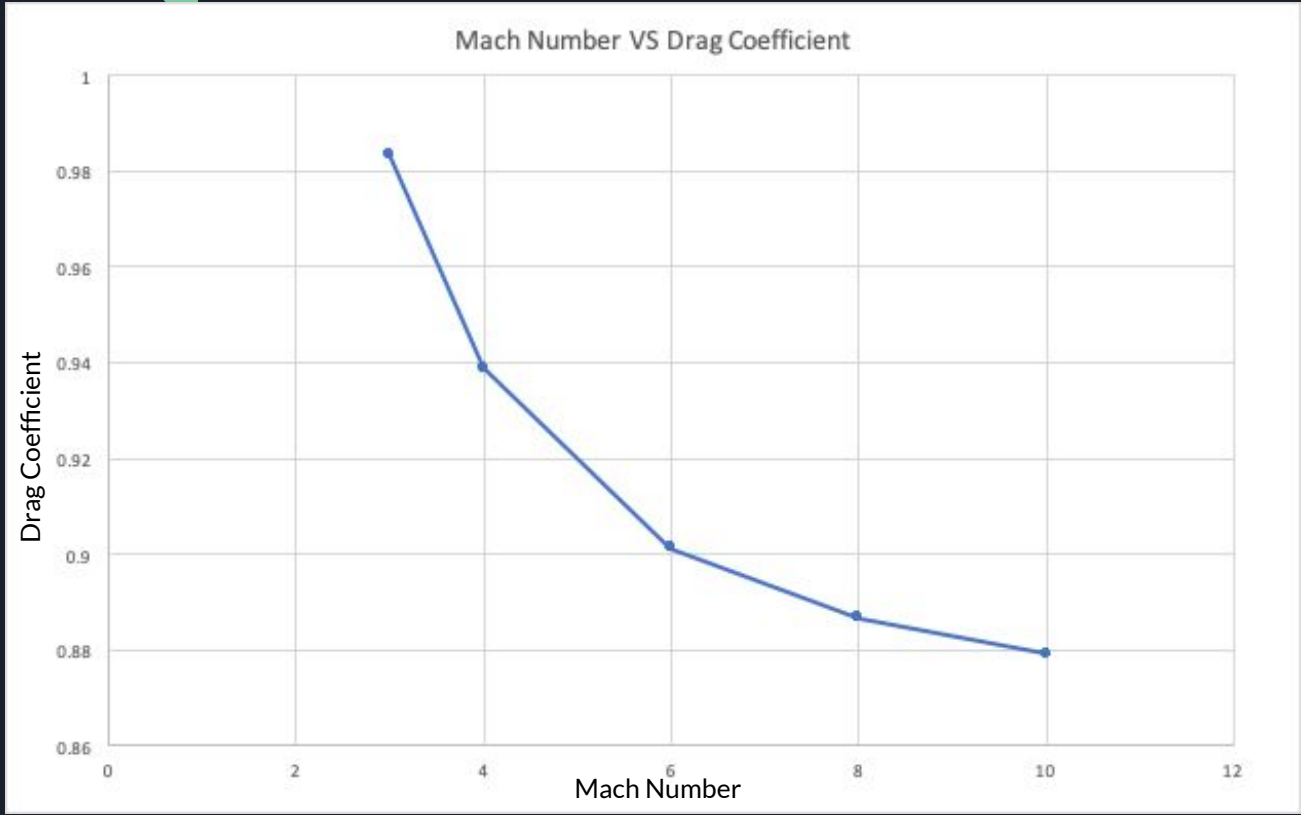
The Effect of Mach Number on Drag Coefficient

$$Cd = \frac{D}{\rho A(V^2/2)}$$

- Drag Coefficient → quantity to represent the drag (resistance) of an object in a fluid environment
  - Usually determined experimentally
- Mach number independence principle → the drag coefficient should become constant as the Mach number increases
- As Mach number increases, drag coefficient decreases

Results

Mach Number	Drag Coefficient
3	0.98349
4	0.93873
6	0.90121
8	0.88659
10	0.87913



Mistakes Made

- Waking up late for meetings
- Taking notes on my desk
- Using the wrong density to calculate drag coefficient

Lessons Learned

- Ask questions
- Positive growth mindset
- Independence and responsibility
    - Time management
- Patience with yourself

Acknowledgements

- Dr. Stuart Laurence
- Dr. Krug

Questions?