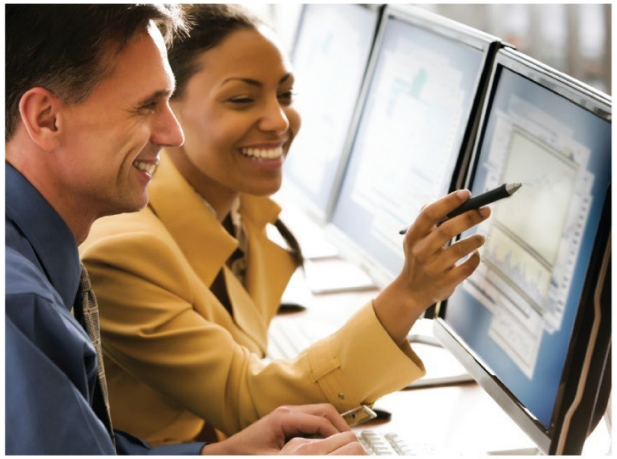
Appendix B: Exercises

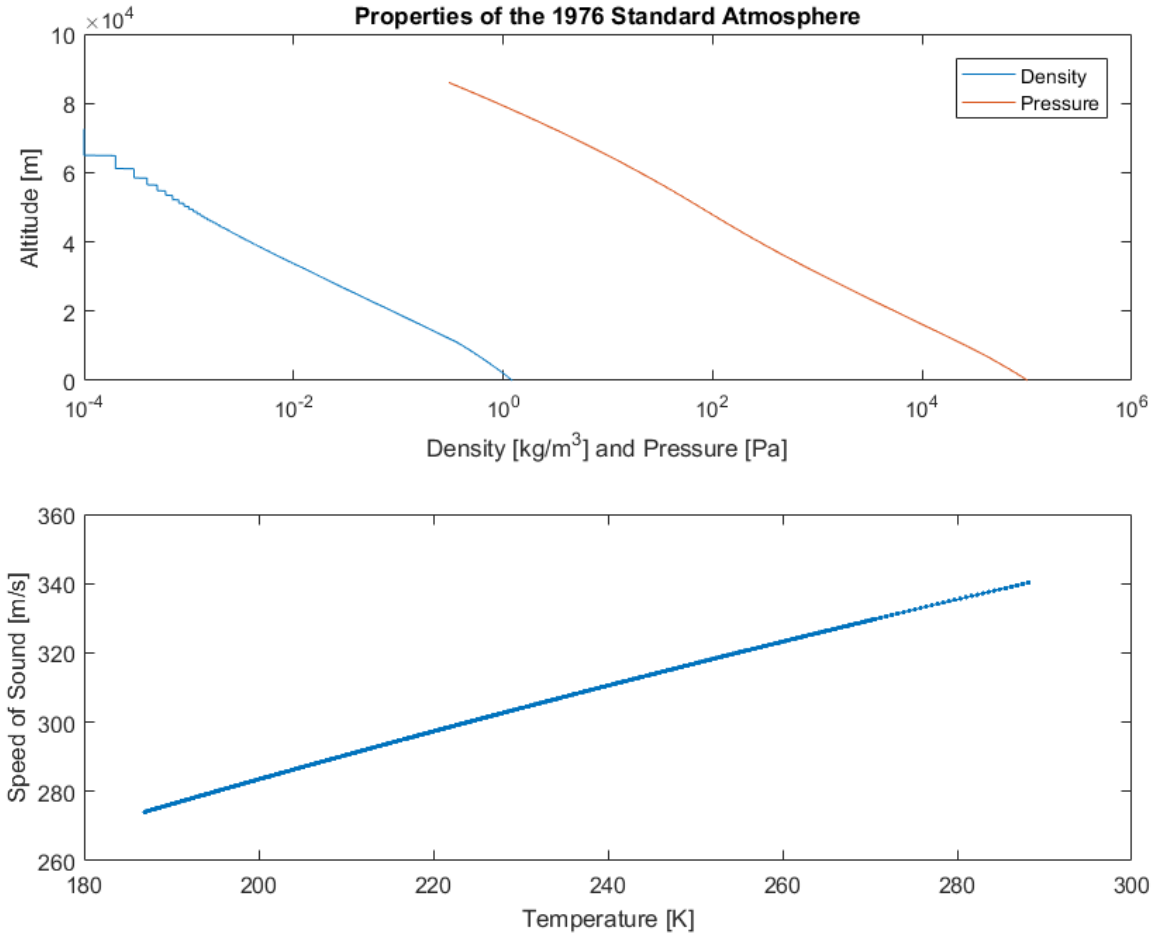
MATLAB® Fundamentals for Aerospace Applications



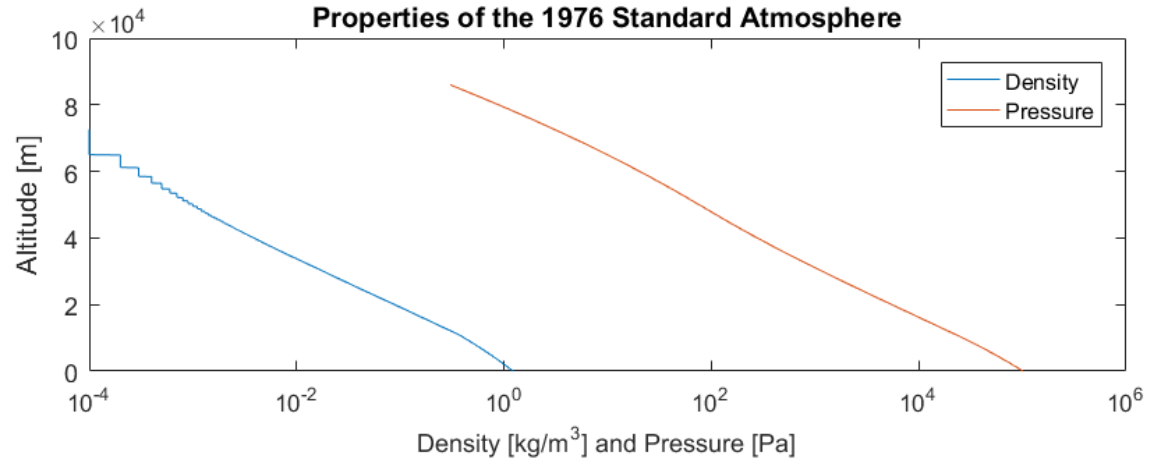
Exercises

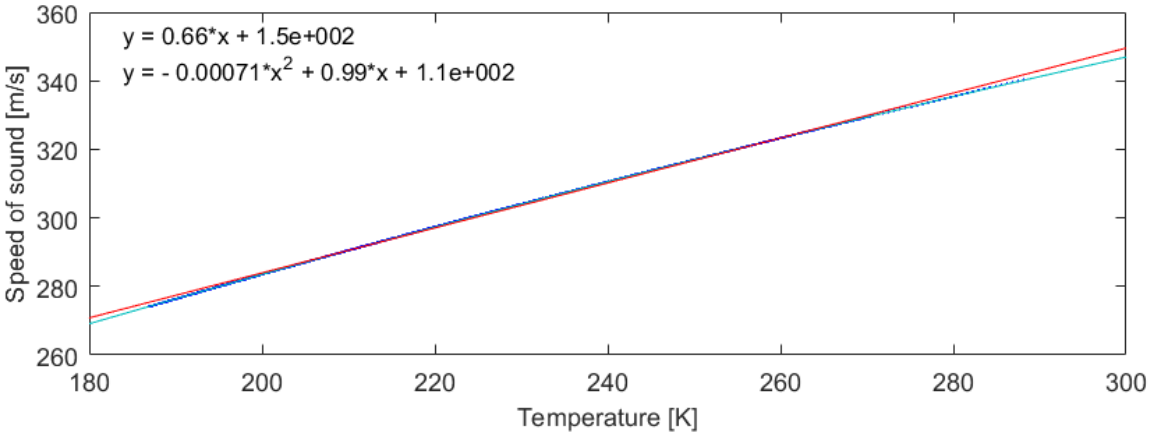
All exercise and solution files are found in the `exercises` subfolder of the `C:\class\coursefiles\mlbe_o` folder created by the course installer.

Standard Atmosphere I



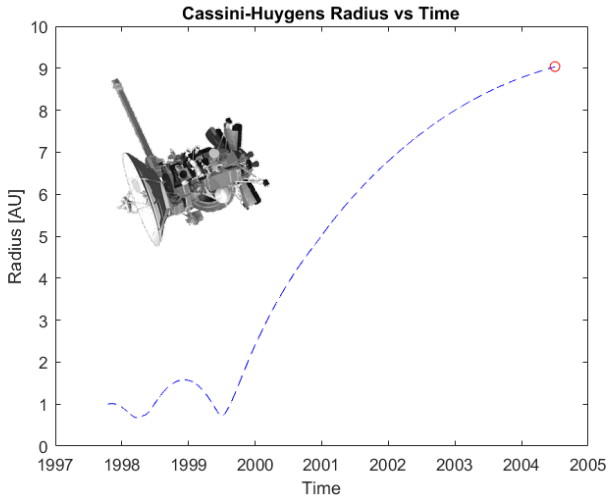
Standard Atmosphere II





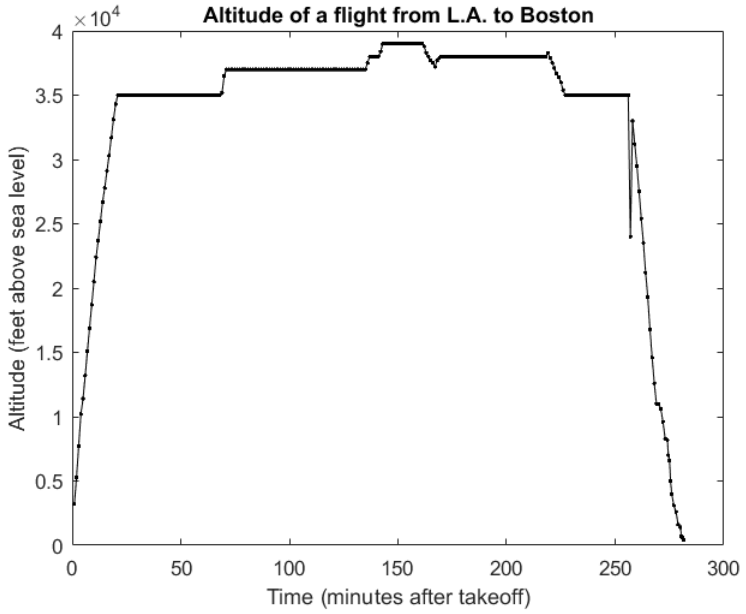
The Cassini-Huygens Spacecraft I

1. Load the file `cassiniData1.mat`.
2. Plot `Radius` vs. `Time` as a blue, dashed line.
3. Add annotations to the plot.
4. The maximum radius occurs at the last time. What is the maximum radius? Plot this value as a red circle on the plot.

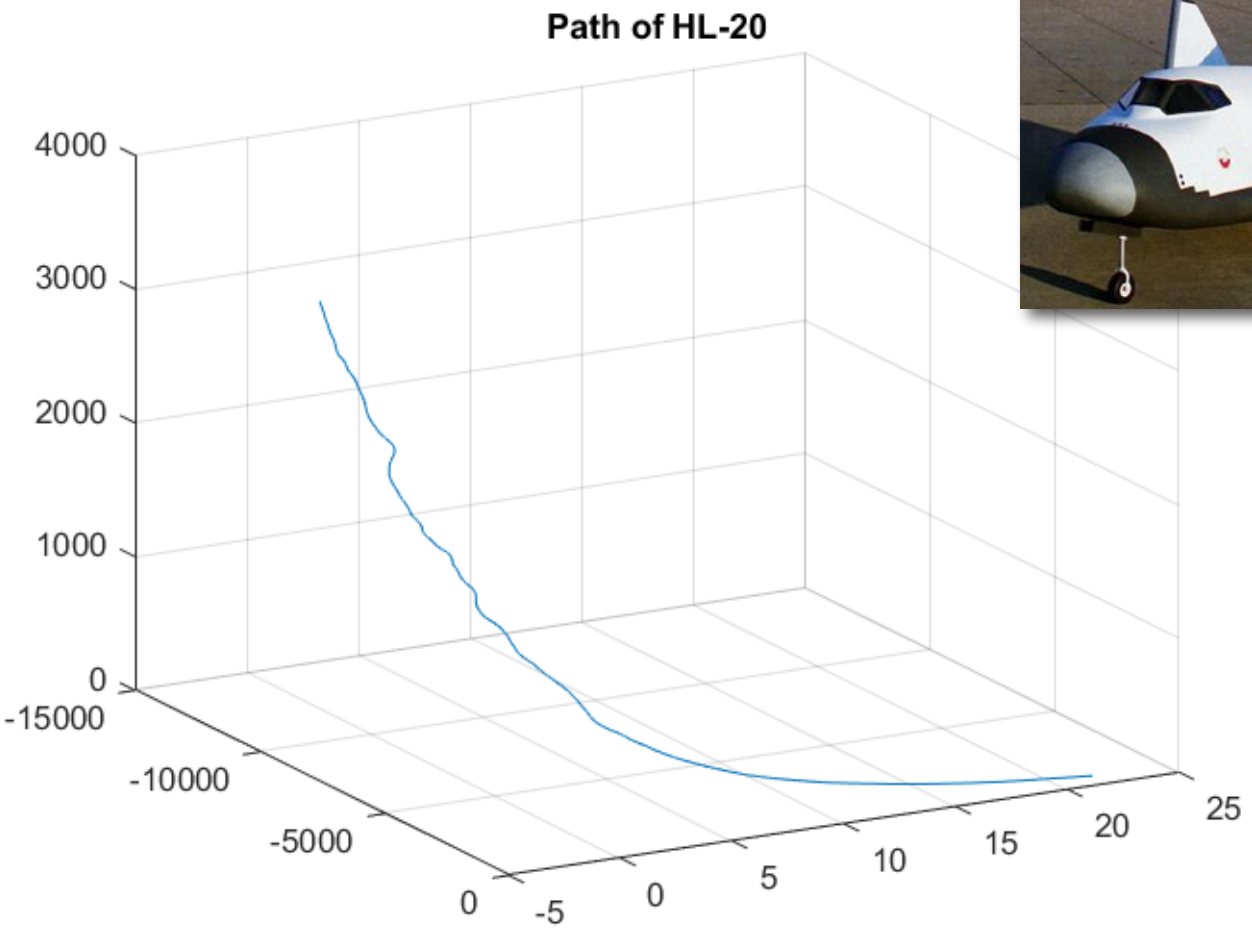


Following a Flight I

1. Load the file `flightData.mat`.
2. Plot `altitude` vs. `time` in black, with points and a solid line.
3. Add a title and axis labels.



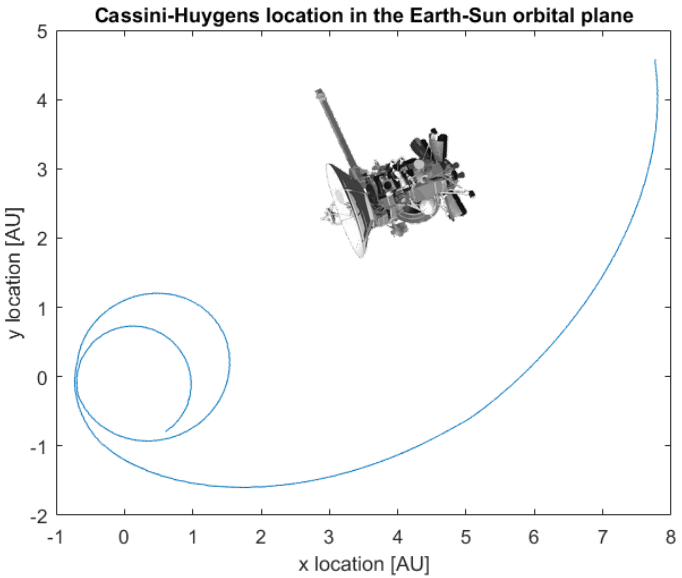
HL-20 Flight Data



The Cassini-Huygens Spacecraft II

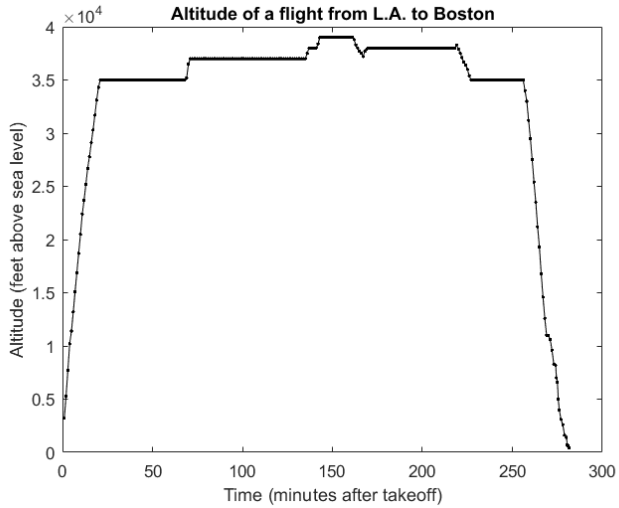
1. Start with `cassiniPath1`.
2. Find the smallest distance to the sun and the year and month that it occurred.
3. Plot the path in Cartesian coordinates:
   - Convert to radians.
   - Use `sph2cart` to convert from spherical to Cartesian coordinates.
   - Plot the *x*-*y* location.

Bonus: Use the `plot3` function to plot the *x*-*y*-*z* location.



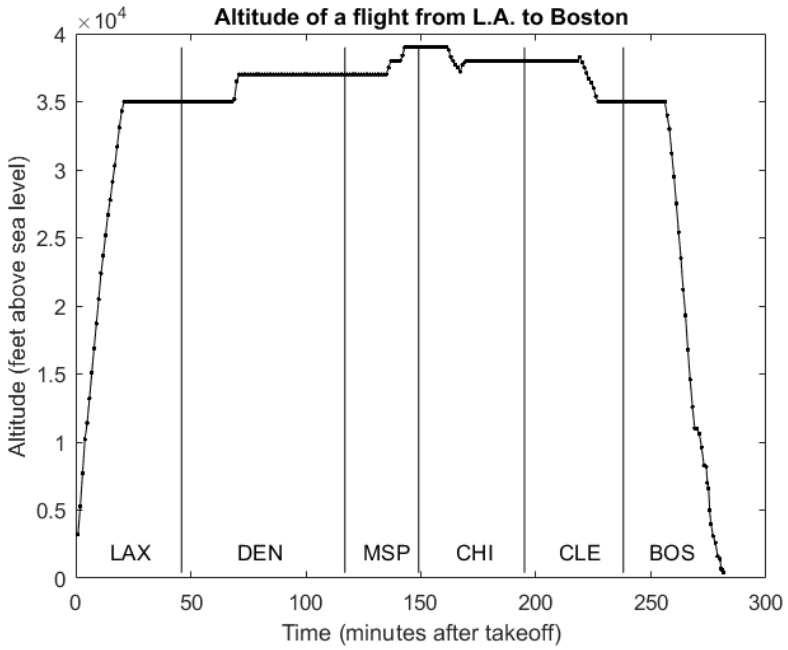
Following a Flight II

1. Start with `plotFlight1`.
2. Find the time at which the altitude was incorrectly recorded.
3. Replace the value of the altitude at that time with the average of the altitude at the times on either side.
4. Plot altitude vs. time.



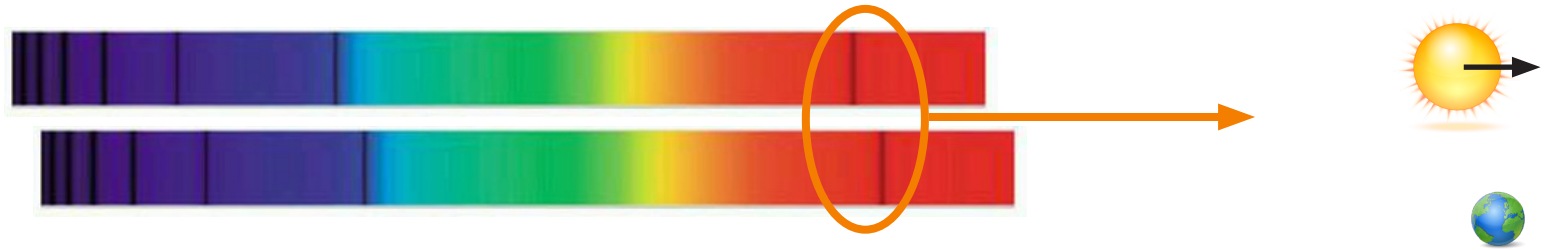
Following a Flight III

1. Start with `plotFlight2`.
2. Add vertical lines at the times between centers.
3. Add text to indicate which center each region corresponds to.

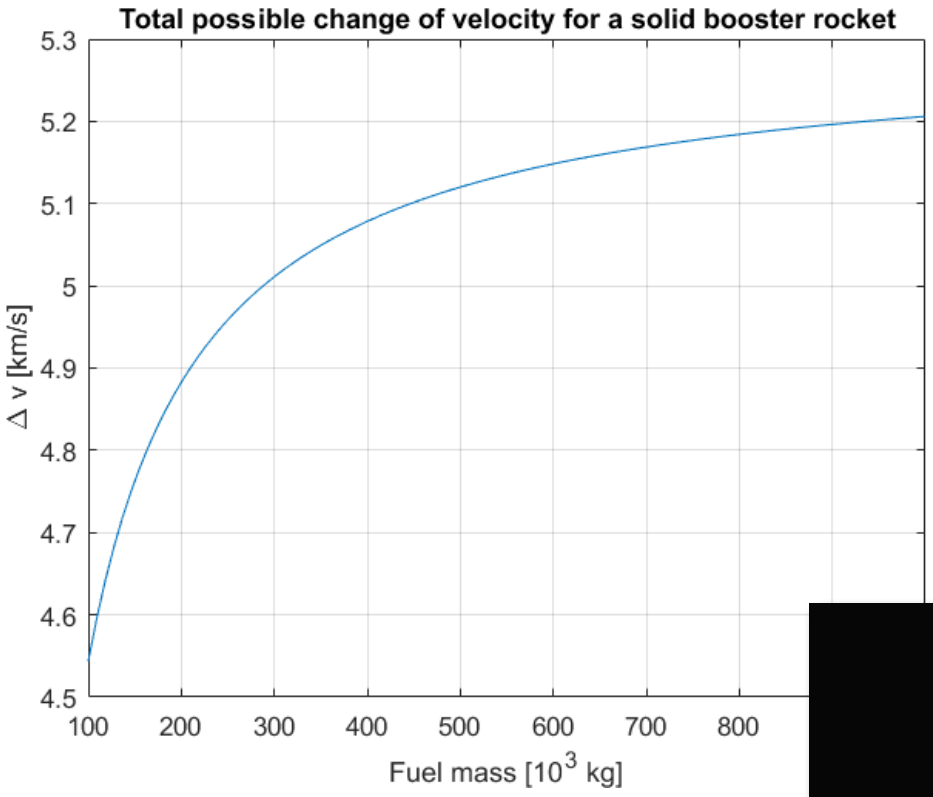


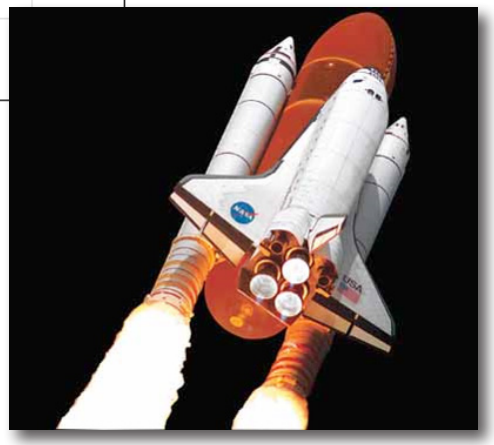
Spectral Measurement

1. Import the first column of `spectra.xlsx`.
2. Create variables `lambdastart`, `dlambda`, `nObs`, and `lambdaend = lambdastart + (nObs - 1)*dlambda`
3. Make a vector `lambda` from `lambdastart` to `lambdaend` in steps of `dlambda`.
4. Plot the spectrum as a function of `lambda`.
5. Add a vertical dashed line at λ = 656.28.
6. Calculate the average flux.
7. Calculate the flux anomaly (absolute difference from mean).
8. Plot the anomaly.
9. Find the location of the maximum anomaly.
10. Calculate the speed of the star relative to Earth.

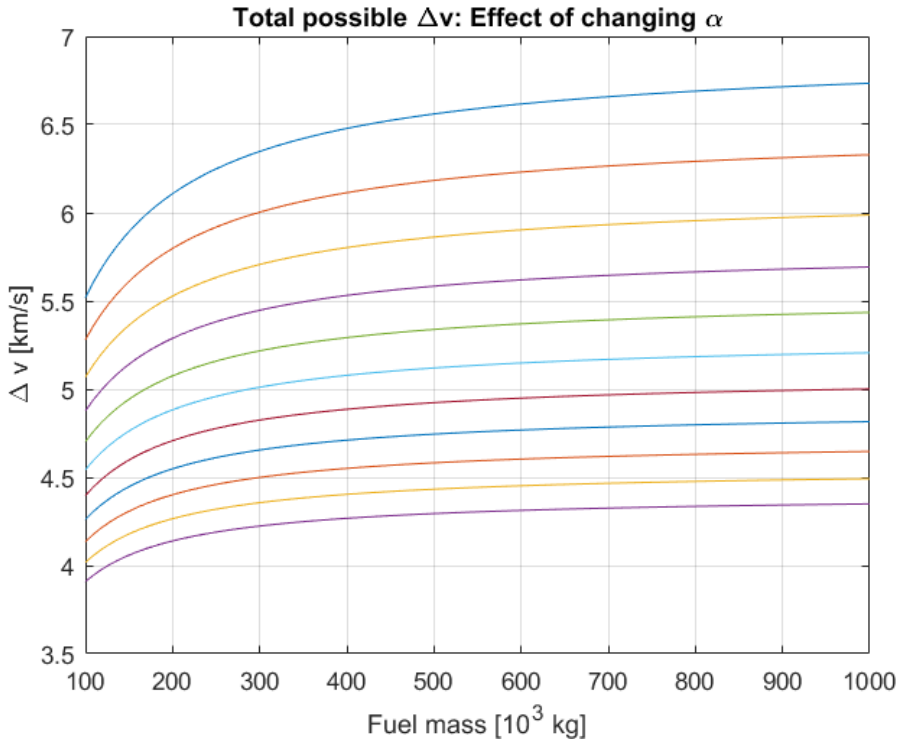


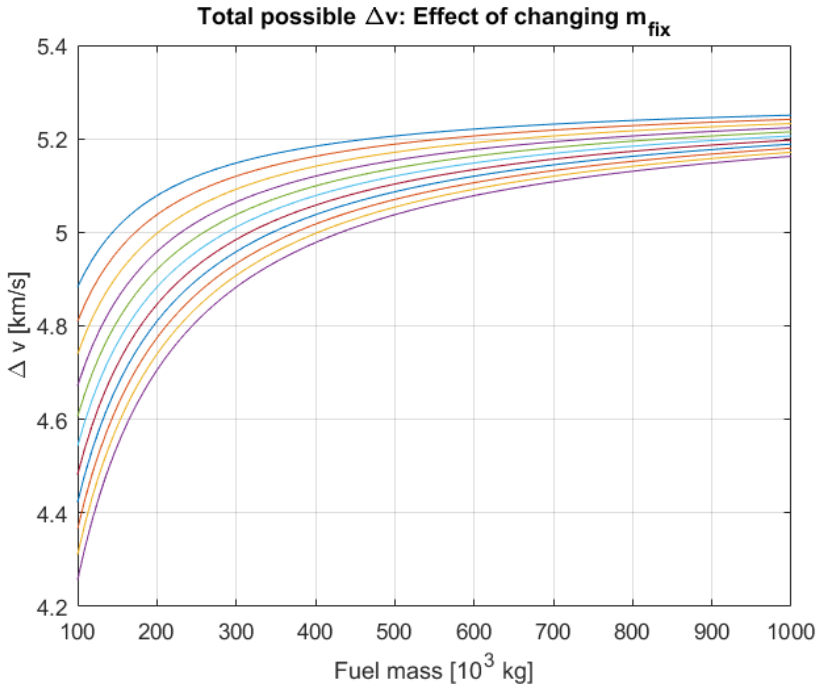
Delta-v for a Booster Rocket I



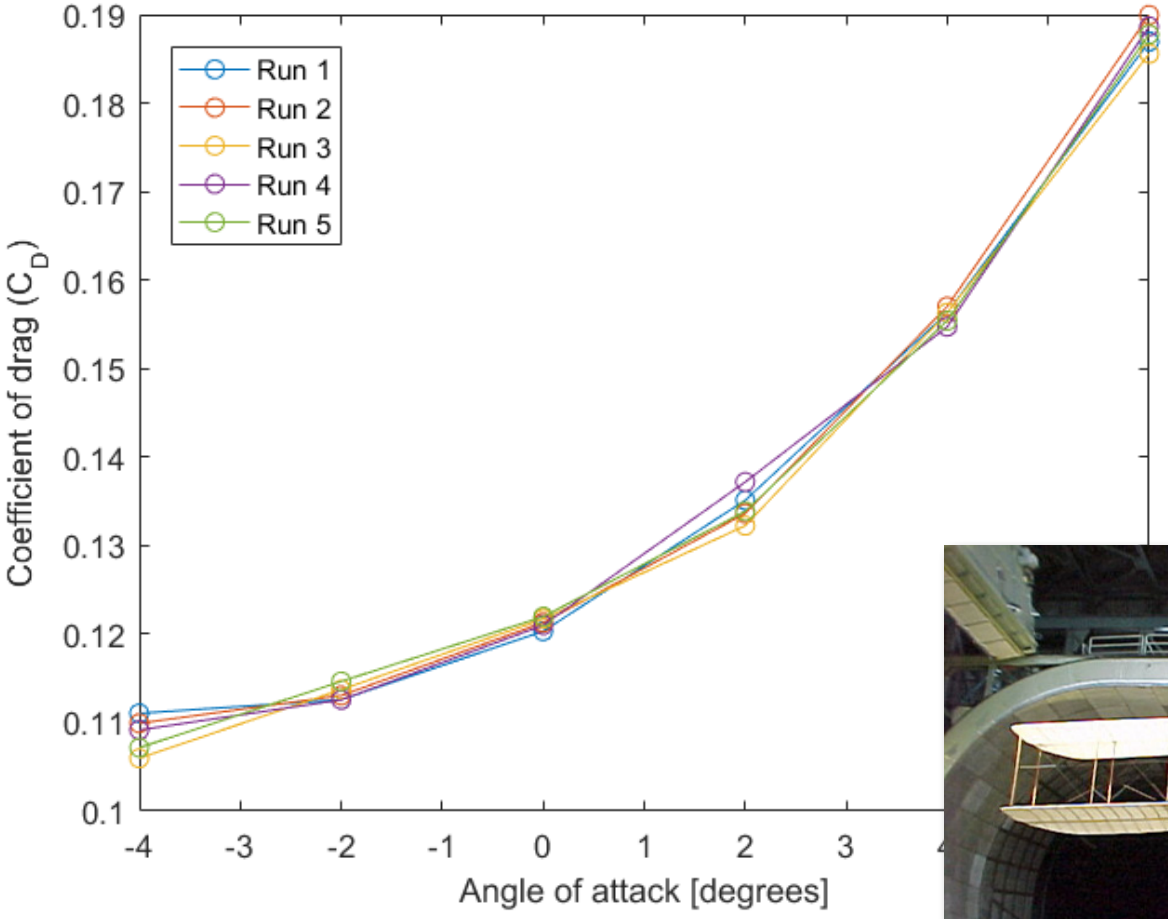


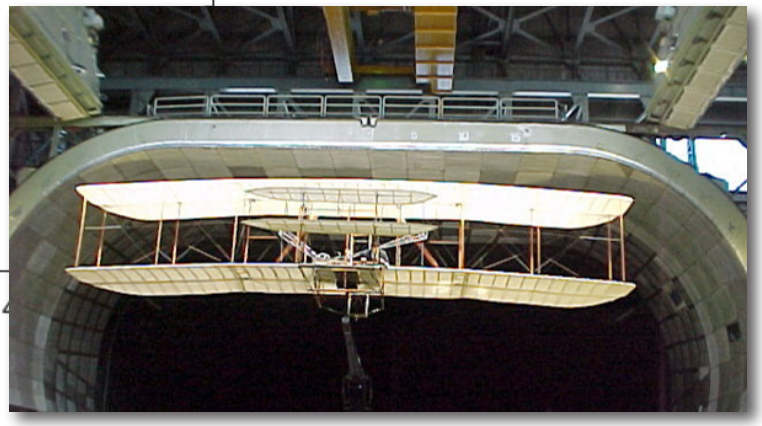
Delta-v for a Booster Rocket II



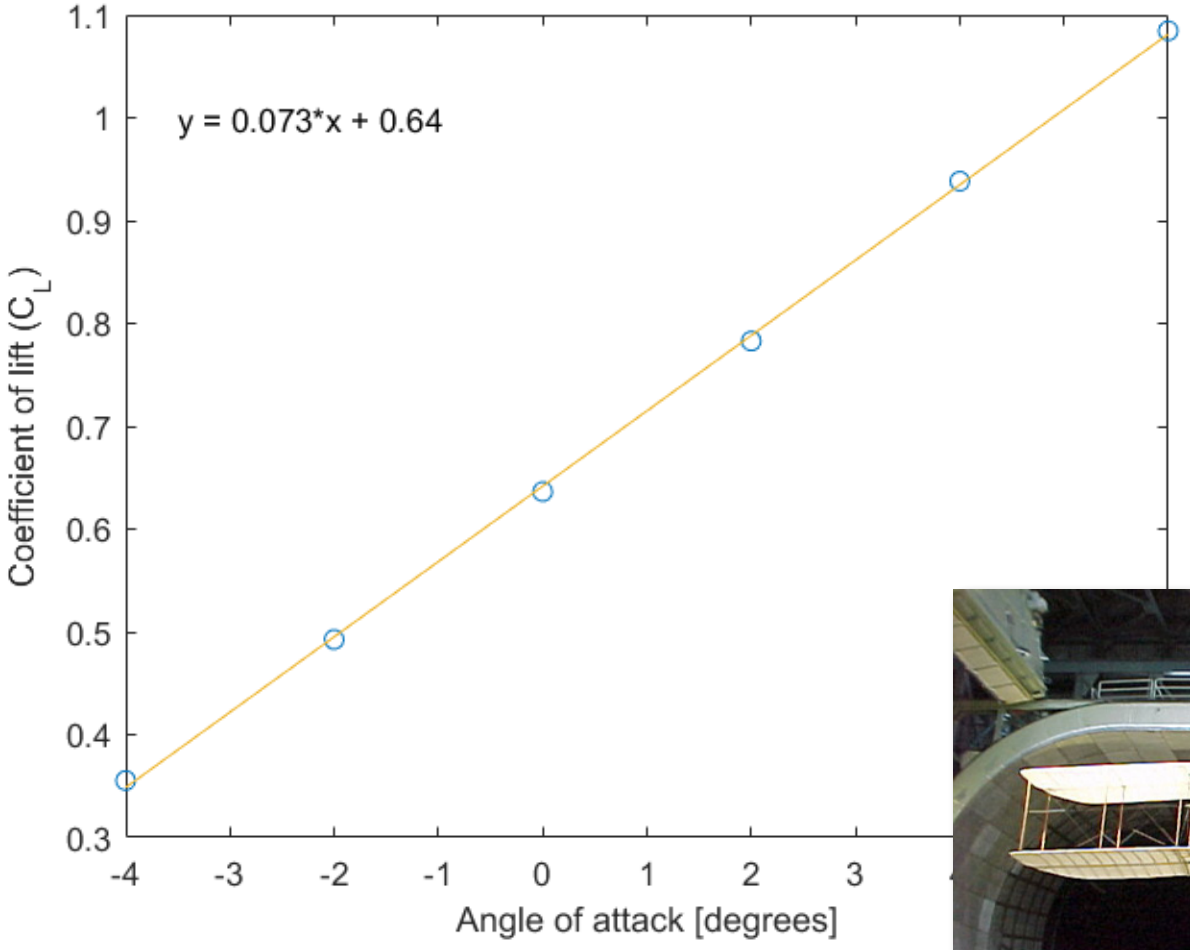


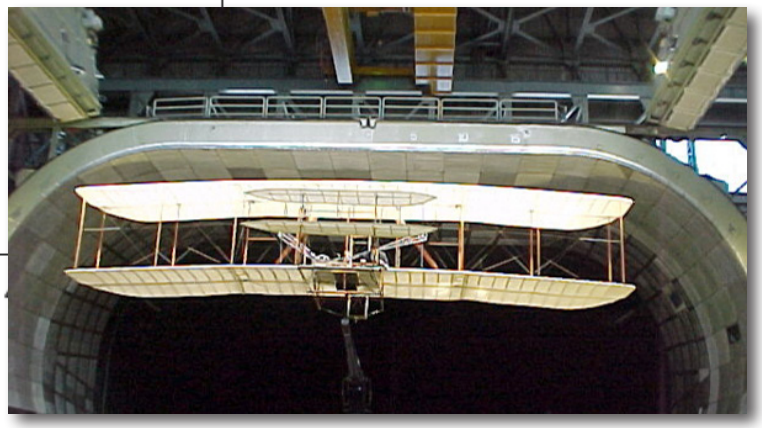
Wright Flyer Wind Tunnel Test I



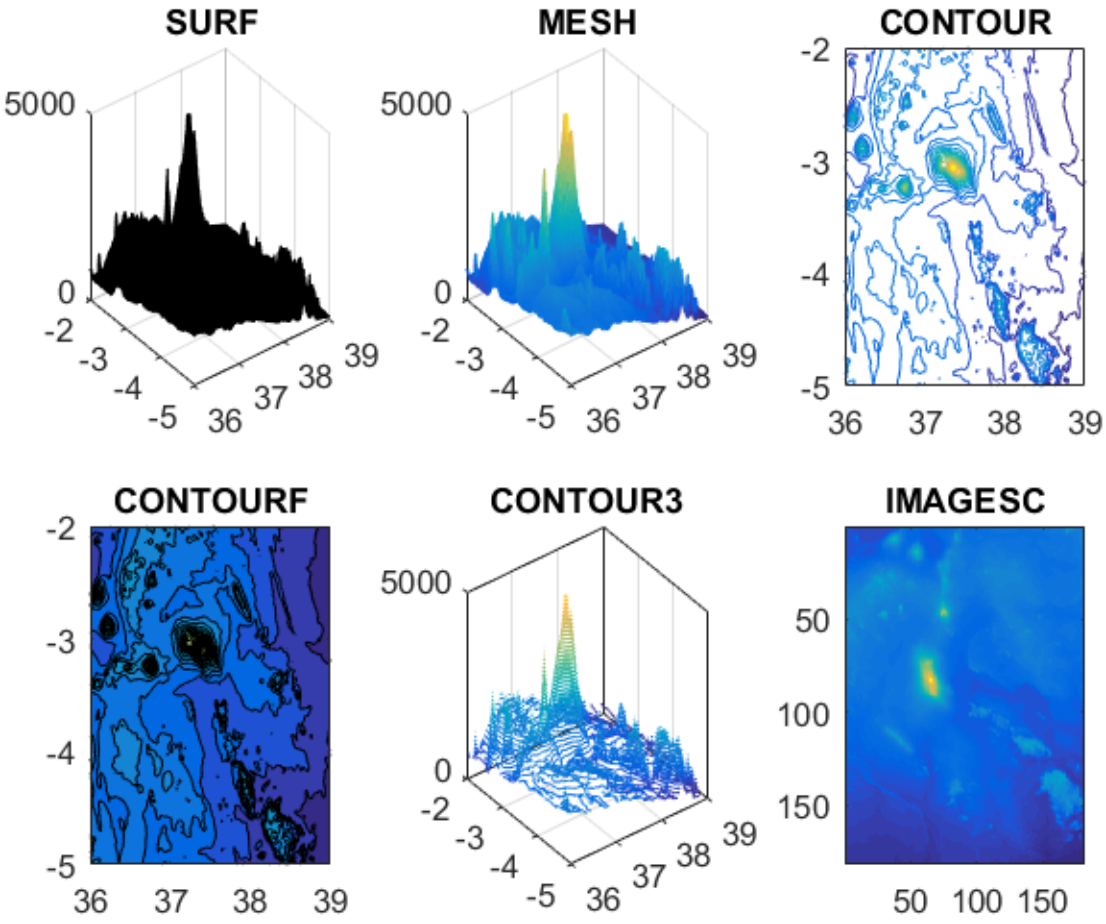


Wright Flyer Wind Tunnel Test II



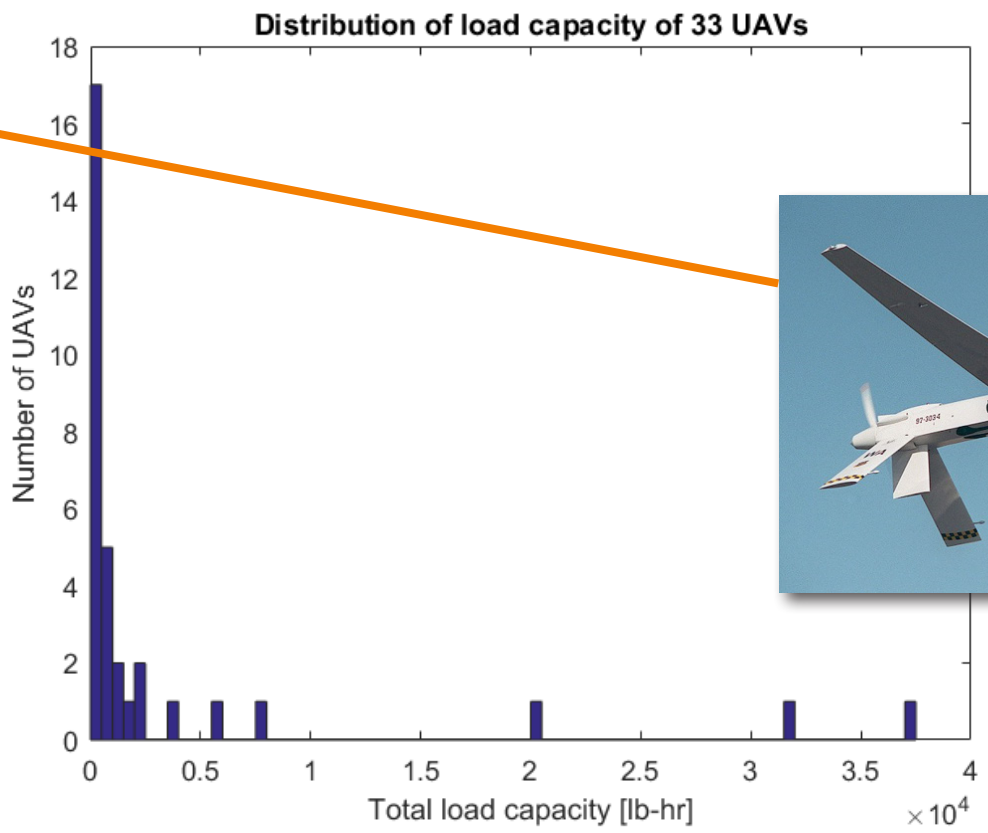


Satellite Terrain Image



UAV Capabilities I

Theseus
Perseus B
Predator
Darkstar
Chiron
Model 410
Eagle Eye
Hunter
Skyeye
Pathfinder
Shadow 600
Outrider
Huntair
Raptor
Firebee
Spectre II
Model 324
...



UAV Capabilities II

Cypher	2.5	45	5000	
Darkstar	8	1000	45000	✓
Eagle Eye	8	300	20000	
Firebee	1.25	470	60000	
Freewing	3.5	50	15000	
Hawk-i 7B	1	3	3000	
Hawk-i 7F	2	12	3000	
Hawk-i 7H	1	5	3000	
Huntair	7.5	80	17000	
Hunter	12	200	15000	
Javelin	1.5	6	3000	
Model 324	2.5	200	43000	
Model 350	1	400	40000	
Model 410	12	300	30000	✓
Outrider	4	160	15000	
Pathfinder	16	88	70000	
Perseus B	72	441	65620	✓
Porter	4	75	5000	
Predator	29	700	40000	✓
Prowler	6	50	21000	
Raptor	8	75	65000	
SASS Lite	5	100	9850	
Seabat	3	50	10000	
Shadow 600	14	100	17000	
Skyeye	10	175	18000	

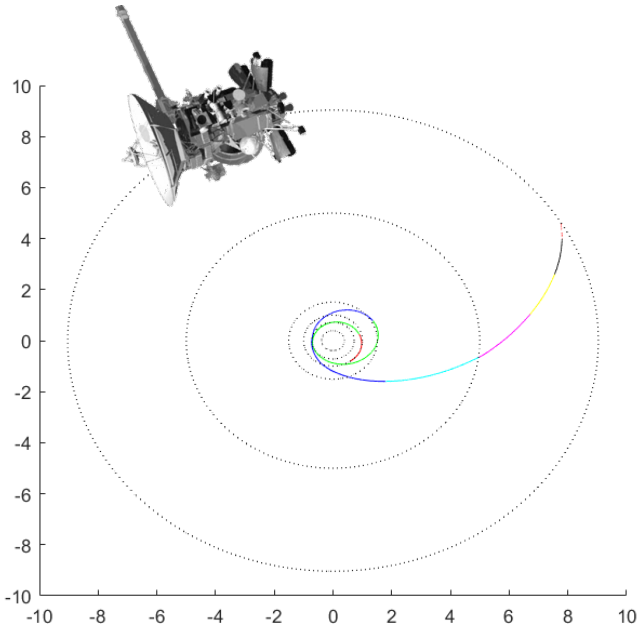
The Cassini-Huygens Spacecraft III

1. Load `cassiniData2.mat` and extract the columns Year, Month, Day, X, Y, and Z. Using X, Y, and Z, compute the radius.

2. Determine the dates when the craft crossed each planet's orbit.

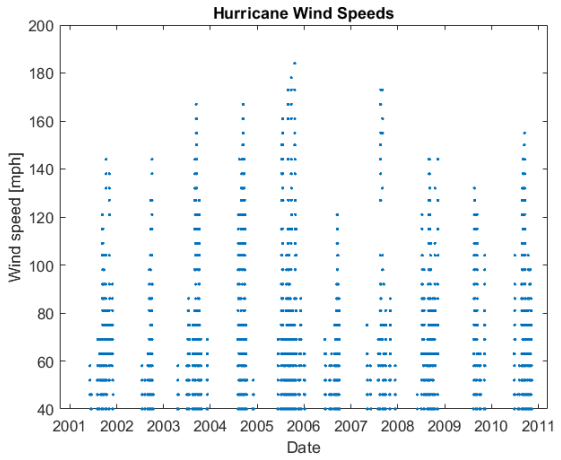
3. Plot the position of the craft for each year in a different color.

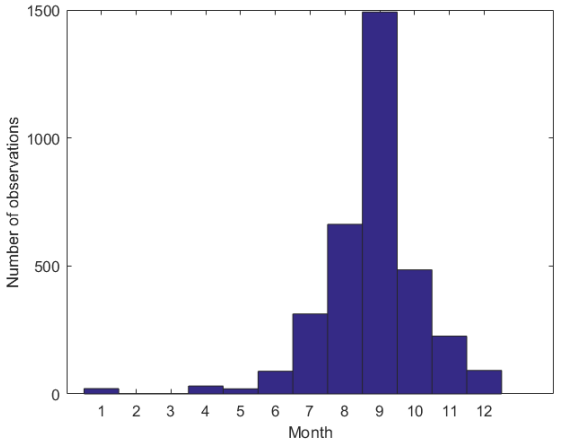
4. Add the orbits of Mercury, Venus, Earth, Mars, Jupiter, and Saturn.



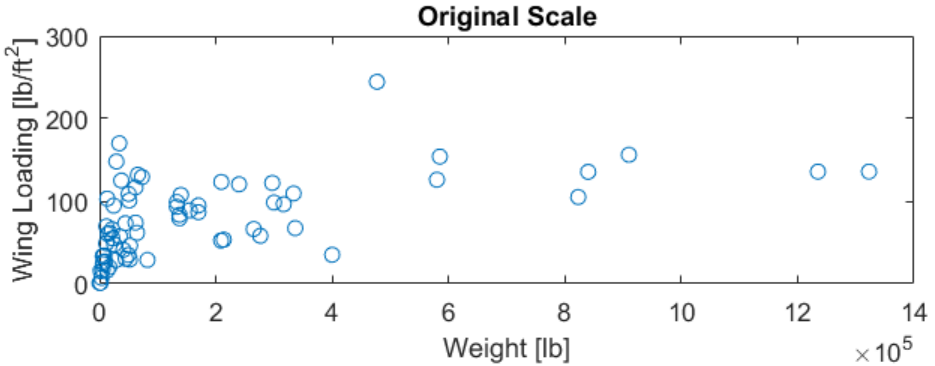
Atlantic Hurricanes

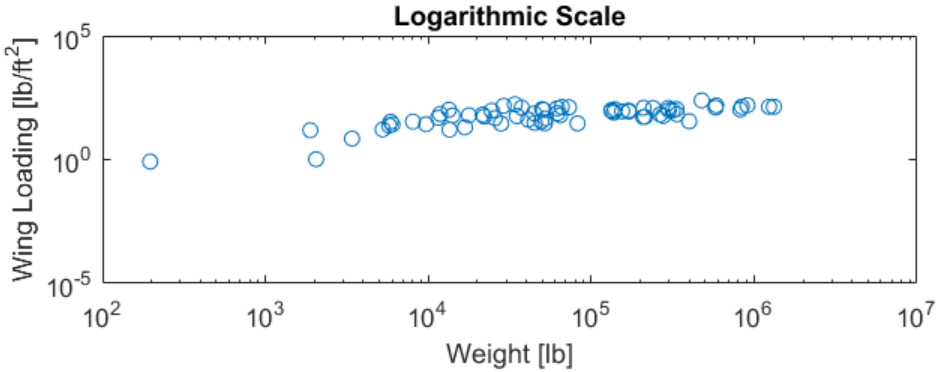
1. Load `hurricaneData.mat`.
2. Plot the wind speeds through time.
3. Find when the top 10 wind speeds were recorded.
4. Find the month in which each observation was made.
5. Make a histogram of the number of observations by month.

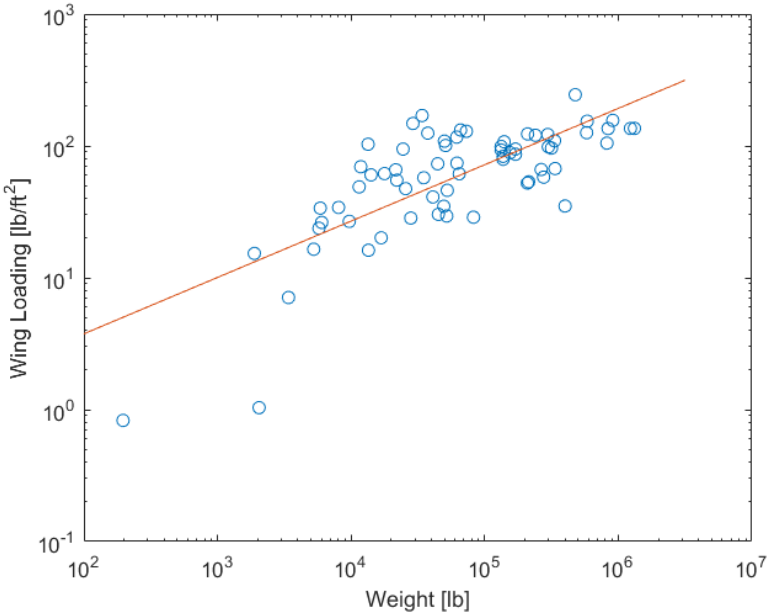




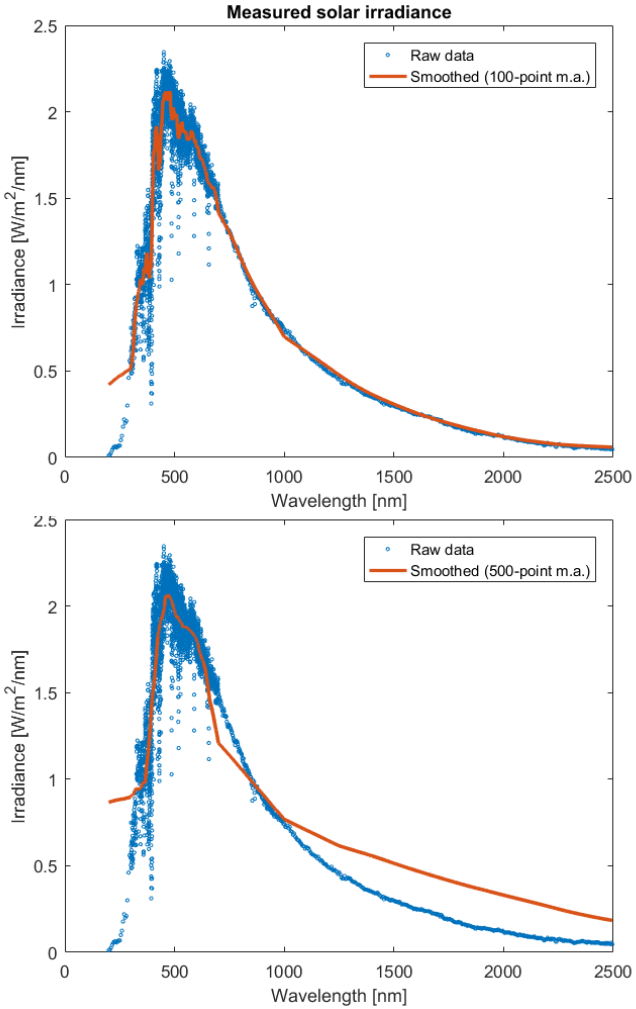
Wing Loading

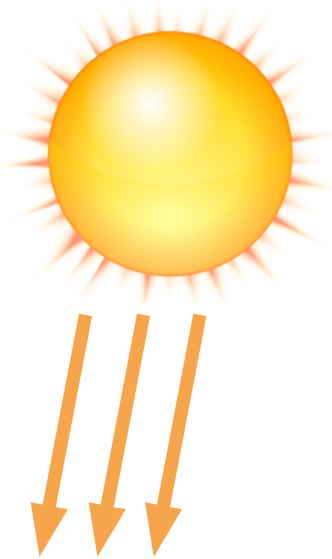




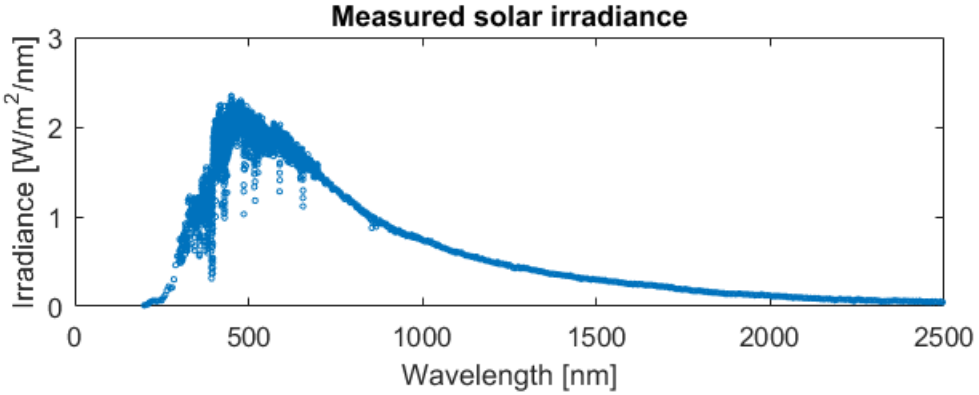


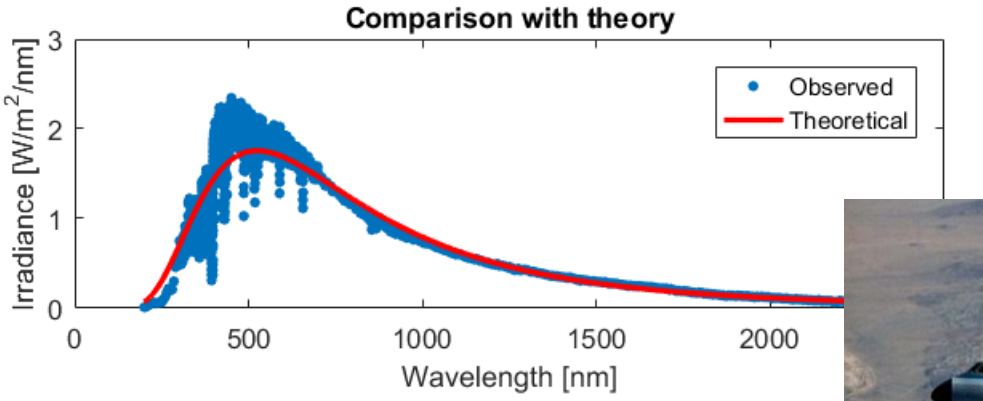
Solar Radiation I

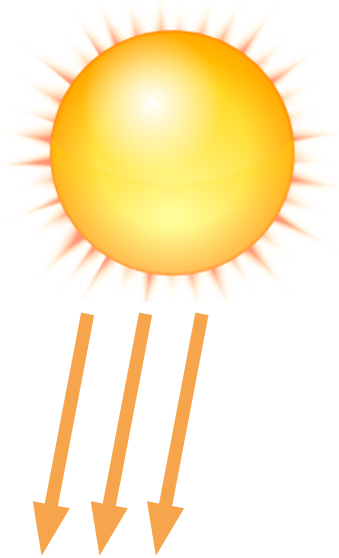




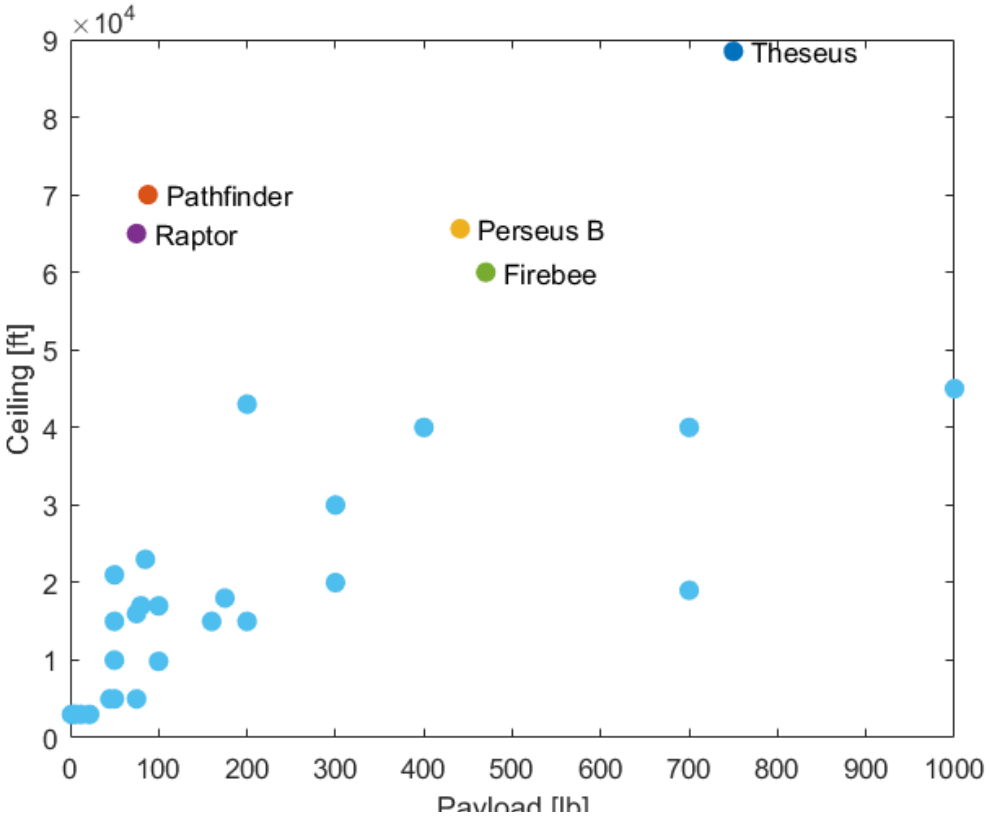
Solar Radiation II



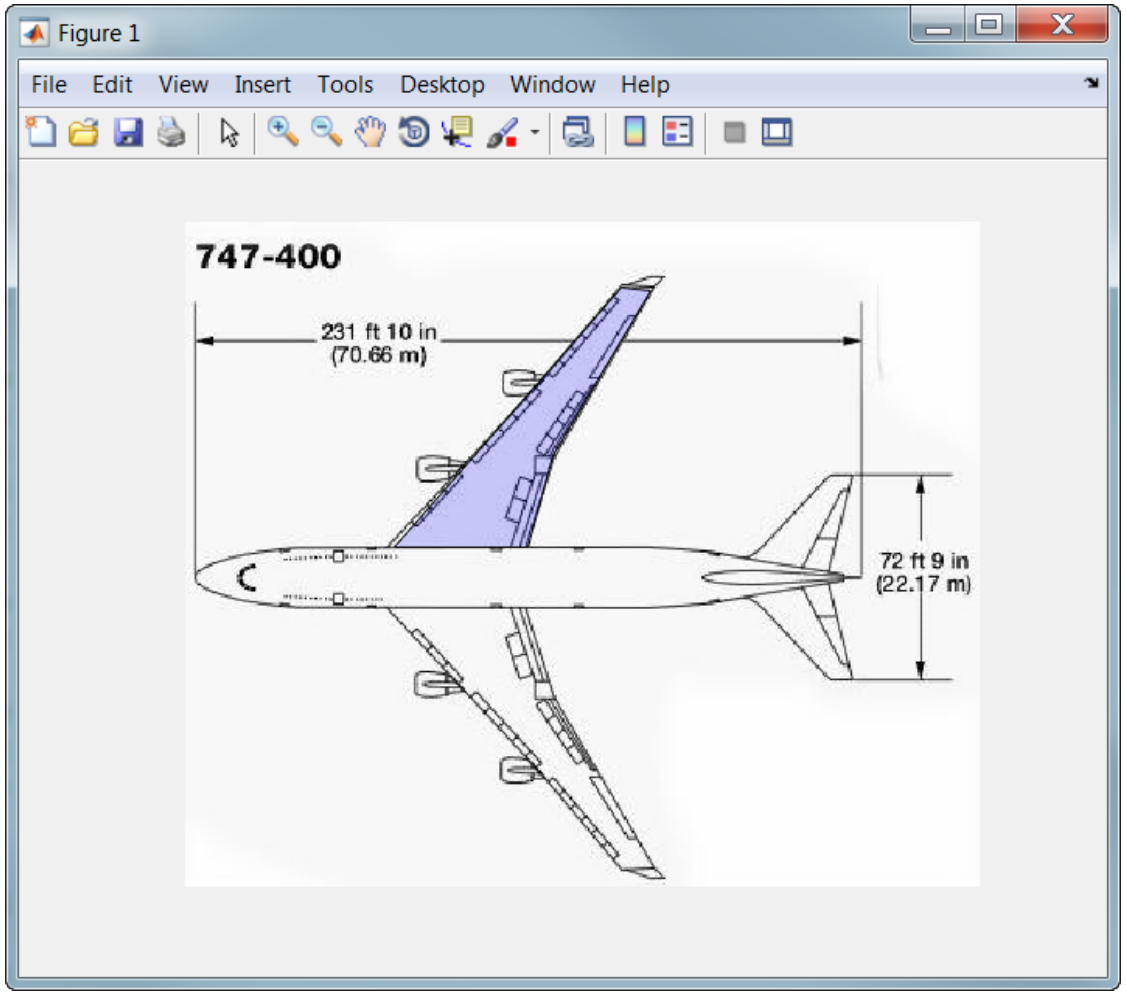




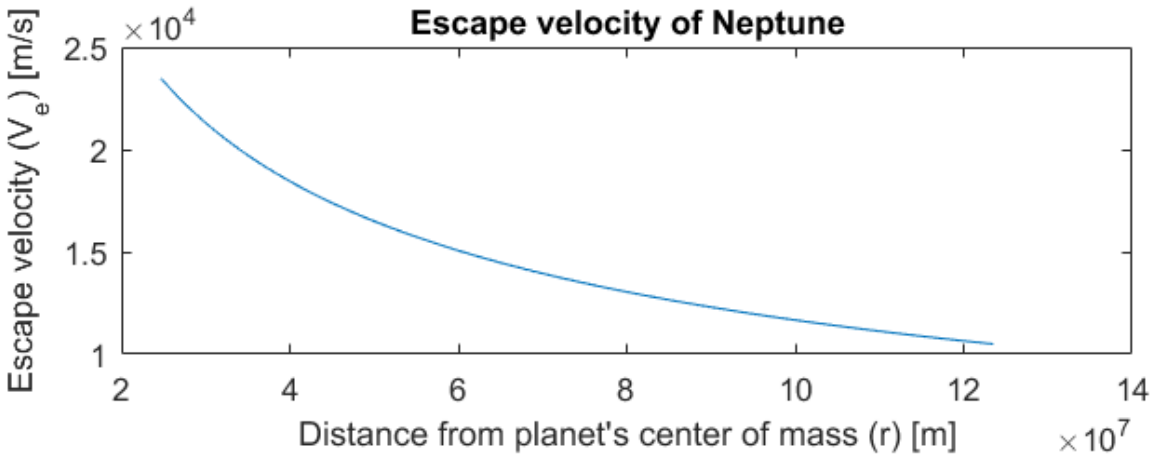
UAV Capabilities III

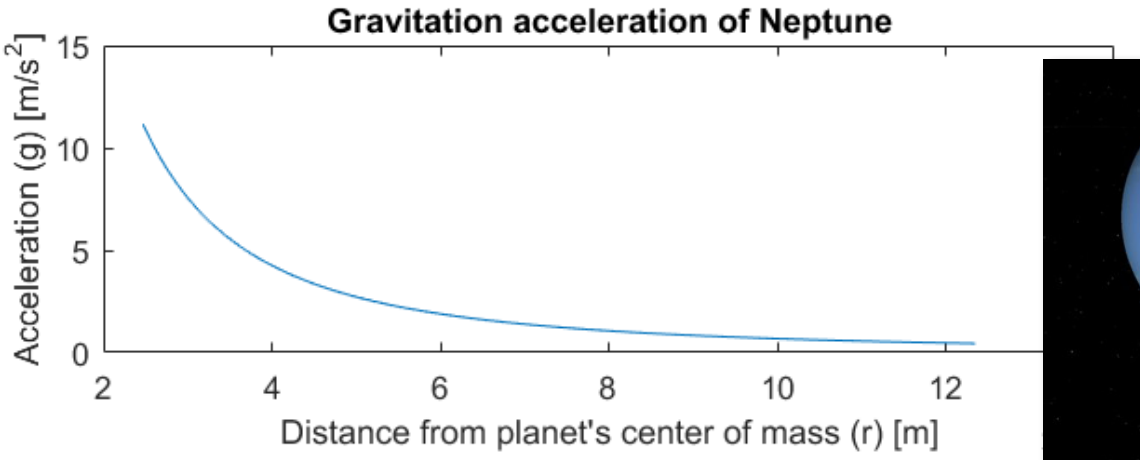


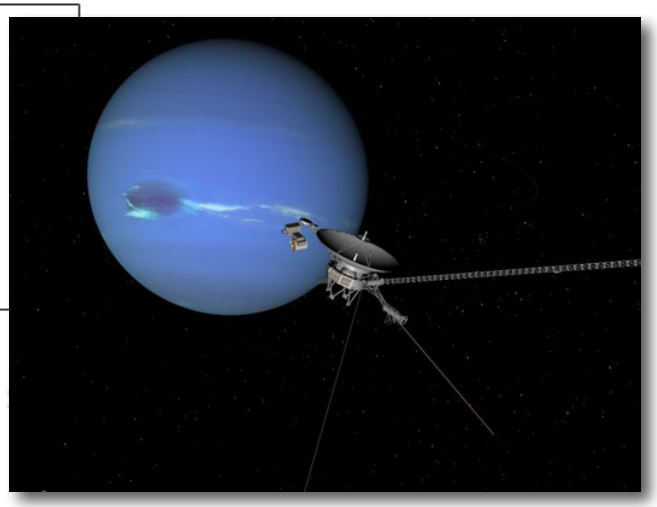
Boeing® 747® Wing Area



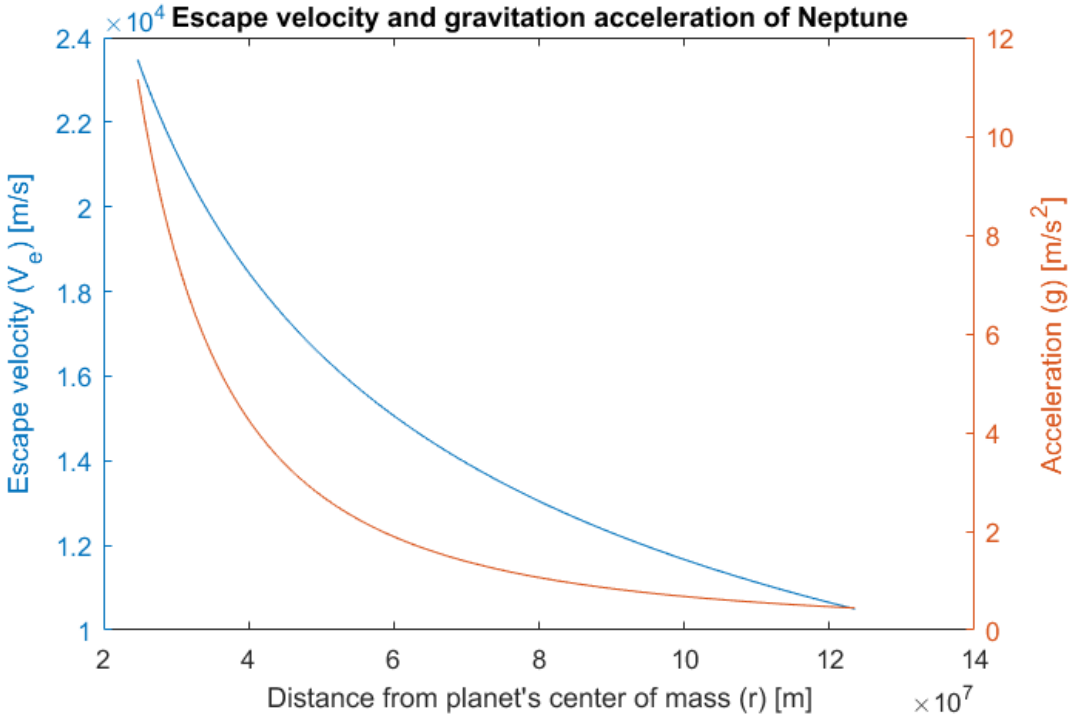
Escape Velocity I

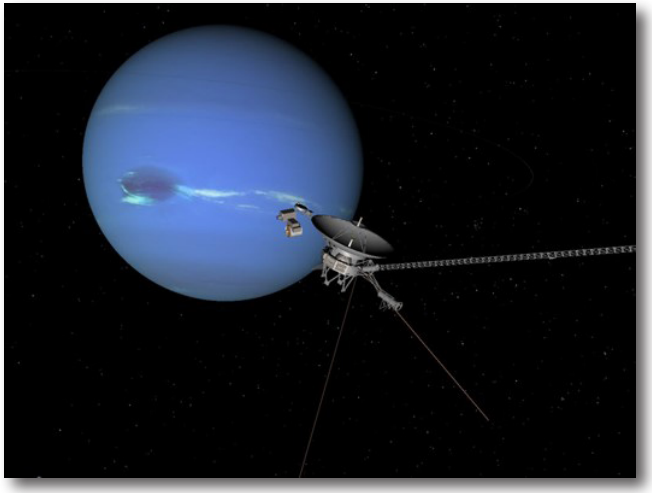




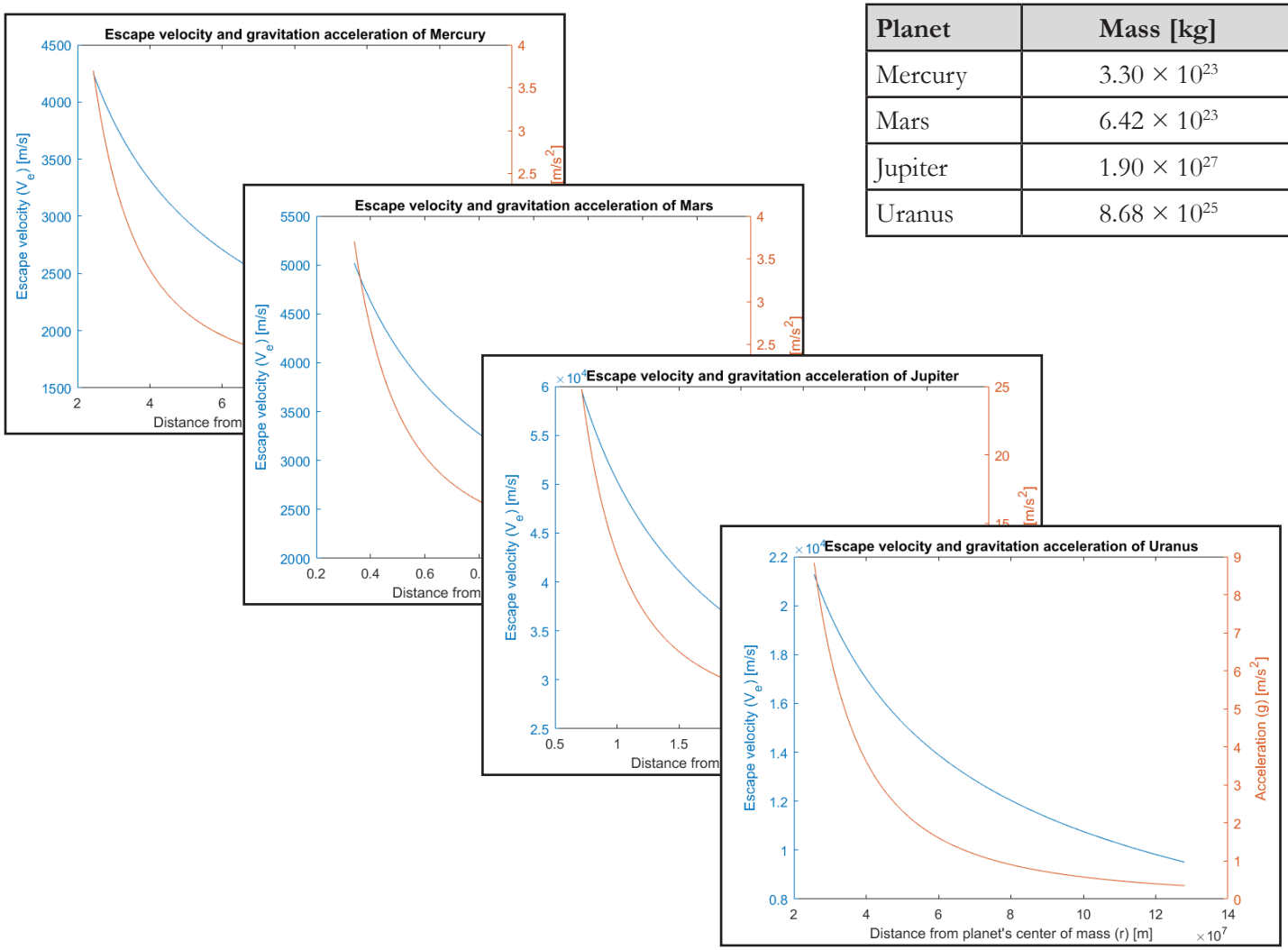


Escape Velocity II





Escape Velocity III



Planet	Mass [kg]	Radius [m]
Mercury	3.30×10^{23}	2.44×10^{6}
Mars	6.42×10^{23}	3.40×10^{6}
Jupiter	1.90×10^{27}	7.15×10^{7}
Uranus	8.68×10^{25}	2.56×10^{7}