

Brookview Elementary School Career Day 2021

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Computational Aerosciences Branch

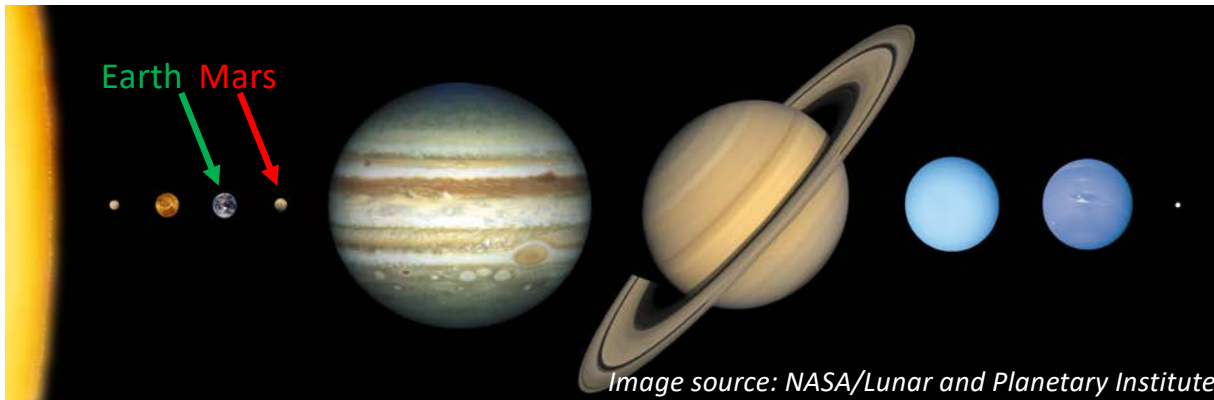
NASA Ames Research Center, Moffet Field, CA

Image source: NASA/JPL-Caltech

Why Mars?



- ❑ Besides the moon, Mars is our most accessible neighbor
 - Mercury and Venus are very harsh worlds for humans (and robots!)
- ❑ Its possible that at one point, Mars was like Earth and supported life and water
 - By studying Mars, we can learn about the future of Earth
- ❑ It only takes about 7 months to reach Mars
 - In the future, humans may be able to live there
- ❑ But, getting **ON** Mars is not easy!



How do you land on Mars?



- ❑ Missions start on Earth with a rocket launch
 - Usually from Kennedy Space Center/Cape Canaveral in Florida
- ❑ The rover that will land on Mars is placed in the top on the rocket



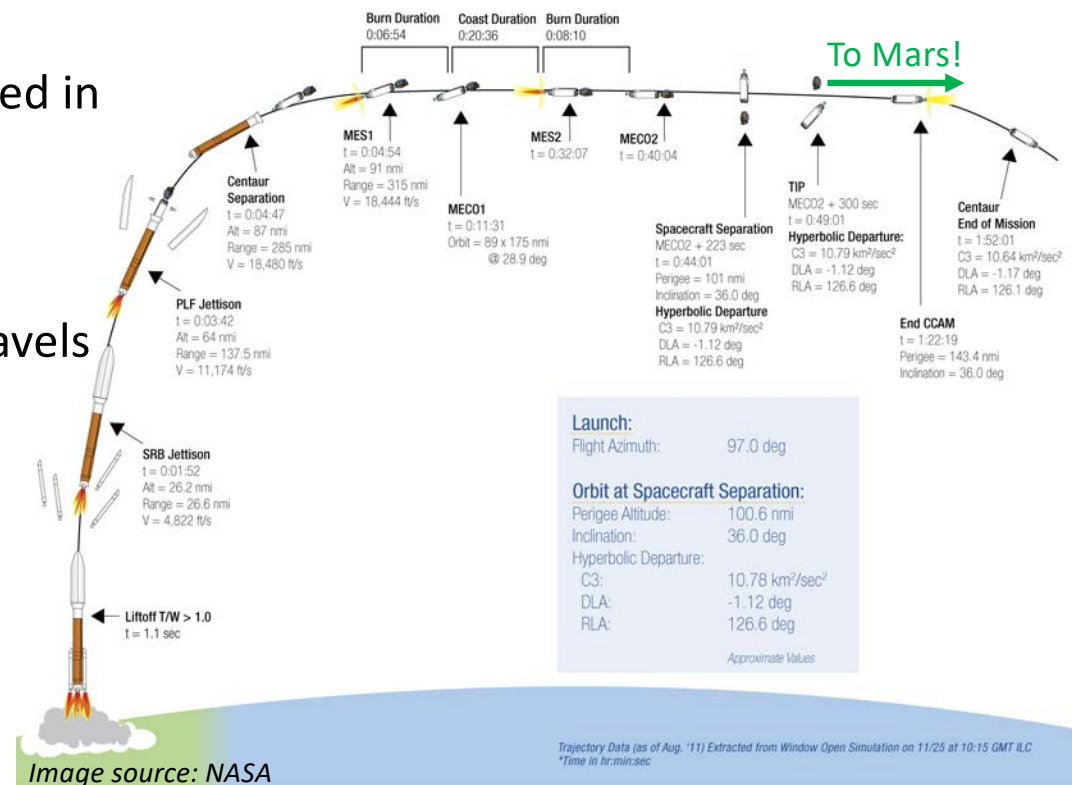
The Perseverance rover is in here!



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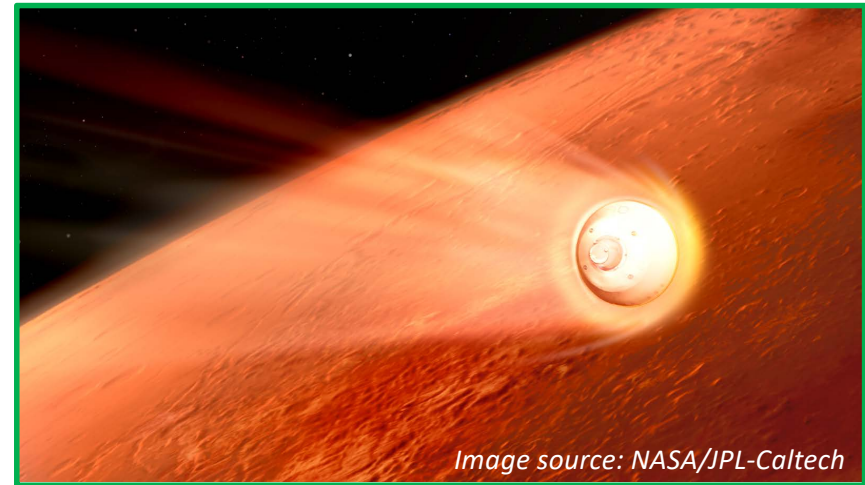
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- ❑ The rover that will land on Mars is placed in the top on the rocket
- ❑ Once the rocket takes off and gets into space, it releases the spacecraft that travels to Mars



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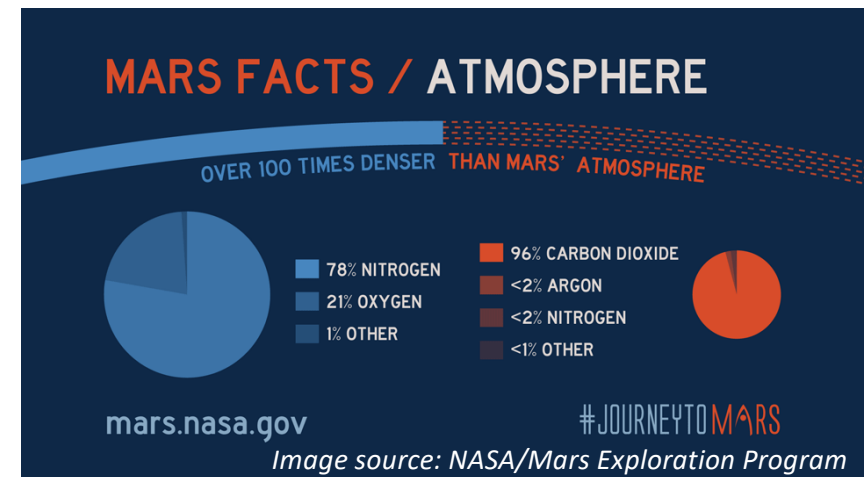
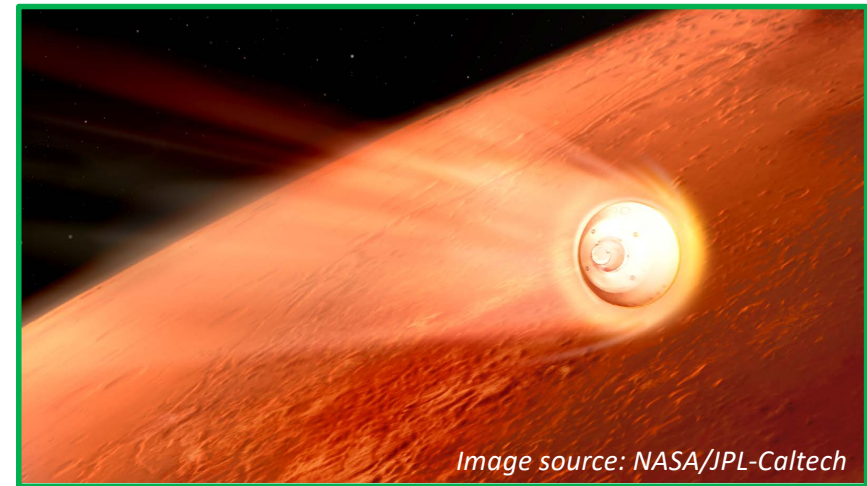
- ❑ Once the spacecraft arrives at Mars, it drops off a capsule, and this capsule enters the atmosphere
- ❑ The capsule moves through the atmosphere at over **13,000mph** (A NASCAR driver goes 200mph)
 - The air around the capsule heats to 2,370 degrees!



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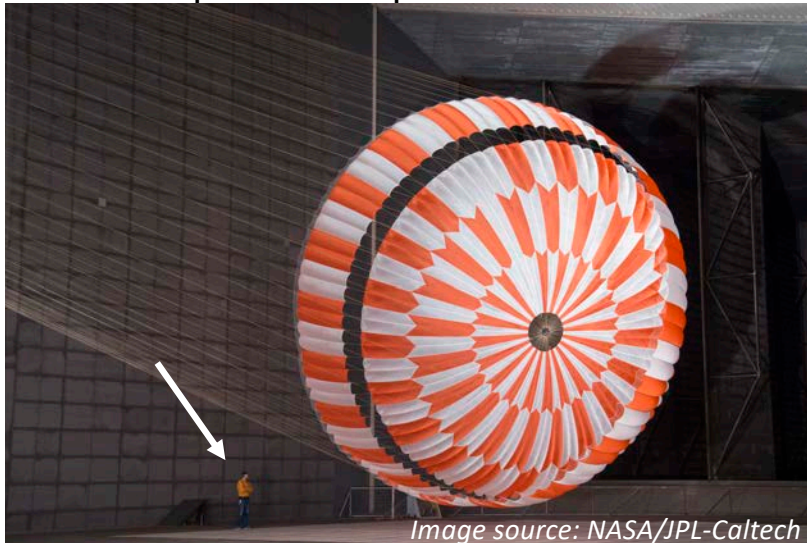
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 - The air around the capsule heats to 2,370 degrees!
- ❑ The Martian atmosphere has a very low density
 - This means that it is hard to slow down
- ❑ Eventually, the capsule slows to 940mph
 - At this point, a **BIG** parachute is released
 - **(This is what I work on)**



How do you land on Mars?



- ❑ The parachute is over 70 feet wide!
- ❑ This is a video of the real one →
 - This was recorded this February on Mars, the parachute is carrying the Perseverance rover
- ❑ The parachute slows the rover from 940mph to 200mph



How do you land on Mars?



- ❑ The rover is still going as fast as a NASCAR, and it is approaching the ground, now what?

How do you land on Mars?



- ❑ The rover is still going as fast as a NASCAR, and it is approaching the ground, now what?
 - The parachute is released and flies away
 - The **sky crane** takes over
- ❑ Small rockets ignite on the sky crane that slow the rover down
- ❑ The rover is lowered to the surface by the sky crane → Touchdown!



So, what was the hard part?



- ☐ Every part of the landing process has a back up plan that can help if a problem occurs

So, what was the hard part?



- ☐ Every part of the landing process has a back up plan that can help if a problem occurs
 - **Except the parachute**

- ☐ If the parachute fails, the entire mission fails, **and they do fail!**



Video credit: NASA/JPL-Caltech on YouTube

How do computers help?



- ❑ Scientists and engineers rely on 2 main methods to solve problems:
 1. **Experimental methods** (observing physics with experiments)
 2. **Computational methods** (simulating physics with computers)

- ❑ Experiments are very powerful, but they can be slow and expensive (\$\$\$)

- ❑ Computers can be faster and cheaper, but they require accurate **code**

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- ❑ If NASA can predict how a parachute will perform **BEFORE** it is flown, missions can be conducted quicker, safer, and with more confidence

- ❑ I write code and run it on supercomputers (→)
 - This supercomputer is faster than all the computers belonging everyone at Brookview Elementary **combined**



How do computers help?



- ❑ What I do is try to model/simulate the real world on a computer
- ❑ This requires a lot of **math** and **science**!
- ❑ Most of my day is spent coding and studying images like this →
 - This is a real simulation that I ran on NASA Supercomputers

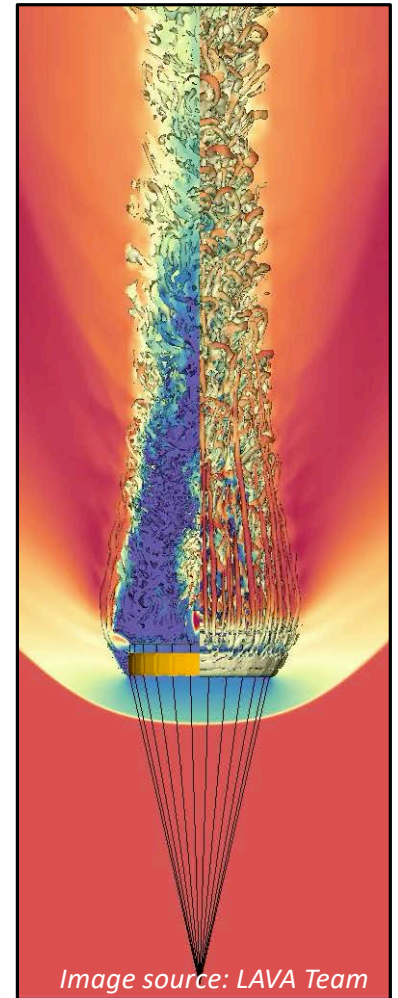


Image source: LAVA Team

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- ☐ Most of my day is spent coding and studying images like this →
 - This is a real simulation that I ran on NASA Supercomputers
- ☐ With a lot of hard work, these simulations may one day help NASA safely land rovers and astronauts on the surface of Mars!
- ☐ **Please let me know if you have any more questions!**

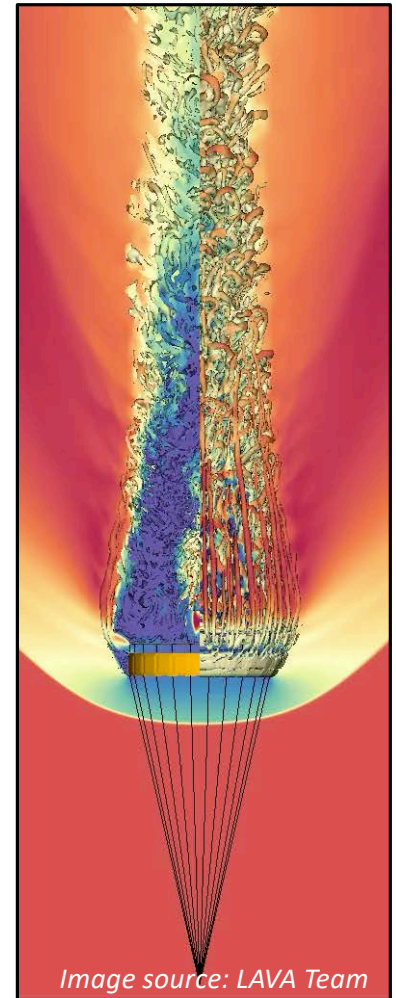


Image Sources:



- ❑ Title slide:
 - <https://mars.nasa.gov/resources/25445/perseverance-rover-decelerating-in-the-martian-atmosphere-illustration/>
- ❑ Slide 2:
 - <https://solarsystem.nasa.gov/resources/686/solar-system-sizes/>
 - <https://www.nasa.gov/sites/default/files/thumbnails/image/pia23729.jpg>
- ❑ Slide 3:
 - <https://www.nasa.gov/press-release/nasa-ula-launch-mars-2020-perseverance-rover-mission-to-red-planet>
 - <https://www.nasa.gov/feature/jpl/7-things-to-know-about-the-nasa-rover-about-to-land-on-mars>
- ❑ Slide 4:
 - <https://mars.nasa.gov/msl/timeline/launch/launch-sequence/>
- ❑ Slide 5/6:
 - <https://mars.nasa.gov/resources/25445/perseverance-rover-decelerating-in-the-martian-atmosphere-illustration/>
 - <https://mars.nasa.gov/all-about-mars/facts/>
- ❑ Slide 8:
 - <https://mars.nasa.gov/resources/24989/wind-tunnel-testing-perseverances-parachute/>
 - <https://www.jpl.nasa.gov/news/testing-proves-its-worth-with-successful-mars-parachute-deployment>
 - df
- ❑ Slide 9:
 - https://www.nasa.gov/sites/default/files/thumbnails/image/rover_drop.jpg
 - https://www.nasa.gov/sites/default/files/thumbnails/image/09_touchdown_10k.jpg
- ❑ Slide 11:
 - <https://www.youtube.com/watch?v=9yRW hu0UGYw>
- ❑ Slide 13:
 - <https://www.nas.nasa.gov/hecc/resources/pleiades.html>