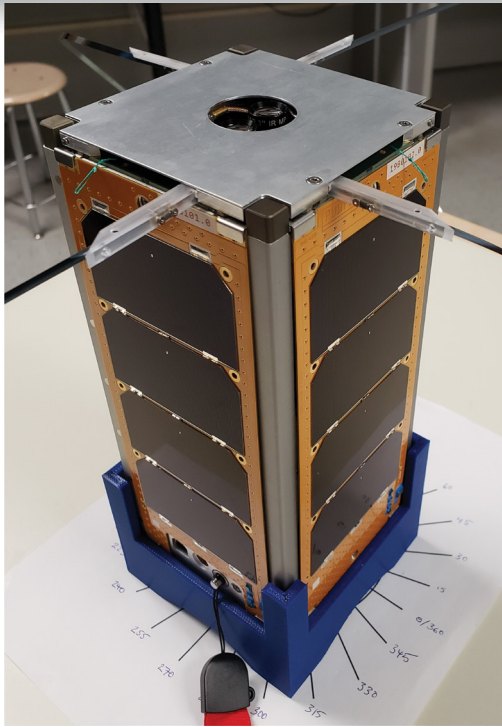




RAMSAT



Oak Ridge Schools - Robertsville Middle School Oak Ridge, Tennessee



Cubesats are a type of small satellite with standardized dimensions. RamSat is a “2U” cubesat, with dimensions of 20 cm x 10 cm x 10 cm. It includes several component systems which work together to carry out its mission. RamSat’s solar panels provide power to charge a lithium-ion battery, which in turn powers a flight computer, cameras, navigational components, and a UHF/VHF radio for 2-way communication with a ground station in the Robertsville Middle School STEM classroom.

Begun in 2016, RamSat is an educational cubesat mission to make observations from space of forests regrowing after wildfires in the Gatlinburg area. The mission is designed and carried out by students, faculty, and mentors at Robertsville Middle School, with support from NASA’s Cubesat Launch Initiative, and sponsorship from numerous community organizations.

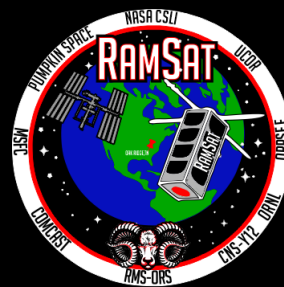
RamSat is being carried to space onboard a SpaceX Cargo Dragon 2 spacecraft, launched atop a SpaceX Falcon 9 rocket, with launch planned for June 3rd, 2021, from NASA’s Kennedy Space Center in Florida. The Dragon spacecraft delivers RamSat along with other scientific cargo and supplies to the International Space Station, docking at the ISS about 24 hours after launch. Just a few days later, RamSat will be deployed from an airlock on the ISS via a spring-loaded launcher, placing our spacecraft into its own orbit 250 miles above the Earth. Traveling about 17,000 miles per hour, RamSat will make a complete orbit of the Earth every 90 minutes.

Students will operate the mission from their classroom, using amateur radio frequencies to listen for RamSat as it passes overhead, sending commands to control the spacecraft, and gathering image data and information about the health of all systems onboard. The mission will last for up to 18 months, after which RamSat’s orbit will have decayed due to drag from the atmosphere, ending with a fiery re-entry and vaporization of the entire satellite.



“Thank you!” to
our sponsors:

- ORPSEF
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- CNS-Y12
- NASA - MSFC
- Pumpkin Space
- RMS-ORS
- Protomet
- Global Testing Labs



Follow our progress online at <https://sites.google.com/view/ramsat>

RamSat: Answers to frequently asked questions...

- What does RamSat do?
 - RamSat uses small cameras to take pictures of regrowing forests, and uses radio communication to send those images to “Ground Control” in the STEM classroom at RMS.
- Where will RamSat be?
 - Once deployed from the Space Station, RamSat will be in its own orbit, traveling about 17,000 miles per hour, at an altitude of about 250 miles above Earth’s surface. It will travel all the way around the Earth once every 92 minutes.
- How does RamSat get power?
 - During each orbit RamSat spends half of its time in sunlight, and the other half in darkness, shaded from the Sun by the Earth. Solar panels on five sides of RamSat generate power during the sunlit half of each orbit. That energy is stored in a lithium-ion battery which then provides consistent power to the other systems during both dark and sunlit periods.
- How do we communicate with RamSat?
 - RamSat has a small radio and antenna system onboard. As RamSat orbits Earth, it sometimes will pass over the ground station at RMS. When that happens, a robotically-controlled antenna on the roof of the school will track the satellite. Each overpass lasts around 5 minutes, and during that time students can send commands to the spacecraft, and downlink image data as well as other information about the systems onboard, known as telemetry. We should have several chances each day to communicate with RamSat during these overpass events.
- Will RamSat stay in orbit forever?
 - No. There is a tiny amount of air at the altitude of RamSat’s orbit, and over time the friction from those air molecules will slow RamSat, causing its orbit to drop closer to the Earth where there is more and more air. Eventually RamSat will experience enough friction that its temperature will rise, and it will burn up as it re-enters the Earth’s atmosphere. We hope to have 12-18 months of operation before orbital decay and re-entry.

RamSat: Technical Data (mass=2.5 kg)

Component	Manufacturer	Notes
Frame	Pumpkin Space	Aluminum with stainless steel rods
Computer	Pumpkin Space	PIC 16-bit microcontroller, C code
Solar Panels	Pumpkin Space	4 large panels, 1 small panel
Sun Sensors	Pumpkin Space, RMS	Integrated in solar panels, op-amps built in-house
Battery	Clyde Space	10 Watt-hour capacity
Magnetorquer	ISIS	Used to point the cameras at Earth
Radio	Astro-Dev	VHF uplink, UHF downlink: 9600 baud
Cameras (2)	Ardu-Cam	1.2 MP, visible and near-infrared

The RamSat team offers special thanks to our helpful and patient launch service providers at **Nanoracks, LLC**.