**To help get the gears turning, here are some ideas the developers of ArduSat have come up with for experiments and apps to run on the satellite:**

**Please leave comments and share your ideas, or enter them in the** [**Discover Space Challenge**](http://www.tinyurl.com/DSCRulesv2)**!**

1. **Meteor hunter:** Small meteors that strike the atmosphere every day created trails of ionized gas in the atmosphere in the upper atmosphere. Write an experiment to try and detect meteor impacts, by listening for radio stationsrizon, reflected by the meteor trails! *(inspired by Phil Johnson, telescope builder and meteor hunter from Calgary, Canada)*
2. **Van Allen:** Detect the South Atlantic anomaly, using the GPS for ionospheric sounding, radiation sensors and cameras, the magnetometer, and more.
3. **Weatherman:** Use the cameras, visible light sensors and color matrix, and spectrometer to look at clouds from above. Based on the reflected light, see if you can predict the weather of where you view!
4. **Radio Astronomy:** Pulsar/solar observations lie within the frequency range out the satellite.
5. **Atomic Oxygen Damage:** Create a rudimentary atomic oxygen damage detector, by pointing a camera at a small plate of carefully-selected material.

# ENGINEERING

1. **Point-and-shoot:** The following settings can be set on the camera:j, "exposure, gamma, gain, white balance, c
2. olor matrix, windowing". Try designing an algorithm that fine-tunes the settings to take even better pictures or more artistic pictures!
3. **Your Eye in the Sky:** Write an app that:

· tracks the movement of your head using a gyro on the ground (like the one we use in our video)

· sends your head-vector to the satellite in real-time

· reorients the satellite in real-time so that the main camera tracks where you're looking

· downloads a confirmation and the actual satellite attitude vector and orbital position to the ground in real time

· produces (based on the satellite vector and position and orbital position) a simulated image using Google Earth of what you

would see if you were there

· on request, snaps an actual picture from space and downloads it to the ground

· MAJOR BONUS POINTS if you can either:

i. tie it in with a virtual-reality/screen on your head that moves with you

ii. post a video update of you using your invention!

### *Send Joel an email (joel@nanosatisfi.com) if you’re interested in this project!*

1. **Space-Processing Metal:** *(One of our more far-fetched ideas!)* what if you could use the temperature extremes in space to cook metals and alter heat treatments, the same way we do on Earth with ovens? Write an app to look at how hot and cold you can make a piece of metal just by reorienting the satellite. Paint a metal with a high-emissivity coating, and:

a) get the metal as hot as possible for as long as possible, as if it were in an oven, by facing it to the sun

b) "quench" the metal with as high a temperature drop rate as possible, by facing it to deep space as soon as the satellite goes behind the Earth (measured with the light sensors).

# ENTERTAINMENT

1. **Geo-Caching from space**: A twist on the classical game! Challenge your friends to identify a landmark/your home country/a set of coordinates with the satellite camera: [www.geocaching.com/](http://www.geocaching.com/)
2. **Photography Competition**: See who among your friends can snap the coolest/most interesting picture from space. The eye of a hurricane, sunrise over the Indian ocean, even aurora from space – see what marvels you can capture!
3. **Rocketeer:** Spot historical space-related sites all over the world: Baikonur, Moscow, Kennedy Space Center, Peenemunde, Kourou, and more!
4. **Geiger Counter Bingo:** Write an app that transmits a message with a random number and letter every time a particle hits the satellite with enough energy. Have a 'bingo from space' game between HAM radio amateurs.
5. **Social Heat War:** This social network game involves 2 or more teams. Each team has the goal to keep its particular side of the satellite as cool as possible by steering it always into the shadow of the satellite. For each “like” you can get on your team’s Facebook post, we’ll move the satellite to point your side away from the sun. Rounds last as long as the satellite is in view of the sun, and the winner is declared by the average temperature of your side for the last 5 rounds.

**FINANCE AND SECURITY**

1. **True Random Number Generator**: Cosmic rays are truly random and can be used to generate a sequence of truly random numbers. These are crucial (and hence valuable) for devising and testing financial models, secure codes, simulations and other scientific and commercial applications.

# SCHOOL PROJECTS:

## Ideas for high school experiments:

* Using the spectrometer, make a spectrograph of the sun and see if you can recognize the different chemical lines in there (e.g. H2 etc.).Repeat over time towards solar maximum and evaluate if results vary accordingly.
* Take pictures from space, and compare them to how an atlas looks in real life
* Detect high energy radiation and expl
* ain where it comes from (EMI and Geiger)
* Map the Earth’s magnetic field, and make a 3D picture of it to compare to the one in the textbook.

**Ideas for university experiments**:

* Compile data from all the temperature sensors on the satellite, and tag each set of data points against the orbital position. Then compare with the theoretical model of sun (about 1400W/m2) and of deep space (almost absolute zero) and validate a theoretical model of the system’s behavior.
* Study the way extreme temperatures warp and twist the structure, by plugging in the values from strain gauges all over the frame into a model of the satellite - even watch it warp in real-time when in range of a ground station (and watch the thermal snap when it goes from the sun into eclipse).
* Compare the structural/thermal response to a finite element model (based on the open source CAD files we provide)
* Write simple PID controllers to test the controls response of the system as you alter the controller gains in real time. See if you can tune the gains to make the satellite respond quickly without oscillating. Or if you’re feeling really ambitious, go for non-linear control!