### Hashtags: #spacetech, #virtualgroundstationapp

Contact: [[email protected]](http://www.cloudflare.com/email-protection)

### Tags: Data Visualization, Platform, Model

**Challenge Description**

An armada of CubeSats is about to be deployed from launch vehicles and the International Space Station creating a swarm of planetary sensors orbiting the Earth. Your challenge is to develop a common antenna kit or directions and an app that can receive data transmitted from these orbiting CubeSats through ground stations around the world to create a global data network. A virtual ground station app that tracks CubeSat locations and downloads their data. The app should visually show the location and path of the satellite and provide data.

**Background**

A CubeSat is a type of space research nanosatellite. The base CubeSat dimension is 10x10x11 centimeters (one “Cube” or “1U”). CubeSats include volumes of 1U, 2U, 3U, and 6U and may weigh up to 1.33 kilograms per 1U Cube. CubeSats provide low-cost, high risk-tolerant payloads to conduct scientific research and technology demonstrations in the space environment.

After CubeSats are deployed, they will begin to orbit the Earth. After forty-five minutes in orbit the CubeSat transmitters will turn on and ground stations will listen for beacons using UHF antennas. CubeSats are tracked using a NORAD ID, assigned by U.S. Space Command, which is used to identify all Earth orbiting satellites and a two-line element that describes the orbits of Earth-orbiting satellites. Once a beacon is heard, universities can determine their satellites functionality and satellites become operational and begin transmitting mission data. CubeSat mission durations and orbital life vary depending on the orbit it is placed in, solar events and its design. A 1U CubeSat may stay in orbit for 180 days. Upon mission completion, the CubeSats fall to Earth, burning up in the atmosphere.

Not all of the spacecraft are communicating via UHF. Some are using S-Band.

CubeSats use a variety of frequencies within the UHF band. Most CubeSats “beacon” at a specific, pre-defined interval. Knowing how often a particular cube beacons (every x minutes), what frequency it beacons on, and roughly where it is in the sky is important to identification/tracking.

**Solution Ideas**

Here are some ways for you to frame this solution (may be implemented by mix of mobile apps or server apps vs peer to peer):

· Design a common UHF antenna kit to automatically track and receive data from a CubeSat

· Define data packets and publish to Amateur Radio community.

· Explain how to interface software to your computer

· Show a map of receiving antennas at network level

· Allow ground stations to input initial CubeSat contact

· Compare initial CubeSat contact data to NORAD ID and two line element to identify CubeSat

· Show aggregate and individual CubeSat tracks

· Show aggregate and individual CubeSat data

· Network ground stations to create a global network to download data

· Provide baseball card style statistics on individual satellites linking it to their data

· Potentially provide user information to denote who is tracking the data

**Sample Resources**

* NASA CubeSat Launch Initiative: <http://go.nasa.gov/CubeSat_initiative>
* How to build an Antenna: <http://www.skyscan.ca/Antennas.htm>
* Definition of Two-line Element Set Coordinate System: [http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/JavaSSOP/](http://spaceflight.nasa.gov/realdata/sightings/SSapplications/Post/JavaSSOP/SSOP_Help/tle_def.html)
* Cal Poly Ground Operator Network: <http://www.cubesat.org/index.php/collaborate/ground-operators>
* Example of Request to Help Track CubeSats: [http://www.southgatearc.org/news/november2013/help\_track\_iss\_ham\_radio\_cubesats.htm](http://www.southgatearc.org/news/november2013/help_track_iss_ham_radio_cubesats.htm#.UuRqz2Qo7ow)
* The CubeSat Ground Station at the University of Arizona: ftp://pirlftp.lpl.arizona.edu/cubesat/cubesat\_papers/gspaper.pdf
* CubeSat-to-Ground communication and mobile modular ground: <http://www.spacegrant.hawaii.edu/reports/16_SUM06-FA06/Ichikawa_Dylan_FA06.pdf>
* Distributed Ground Station Network for CubeSat Community: [http://vtechworks.lib.vt.edu/bitstream/handle/10919/25151/Leffke\_ZJ\_T\_2014.pdf](http://vtechworks.lib.vt.edu/bitstream/handle/10919/25151/Leffke_ZJ_T_2014.pdf?sequence=1)

**NORAD ID:** USSPACECOM object number assigned to all Earth orbiting satellites in order of identification.

Two-line Element: a data format used to convey sets of orbital elements that describe the orbits of Earth-orbiting satellites. A computer program called a *model* can use the TLE to compute the position of a satellite at a particular time.