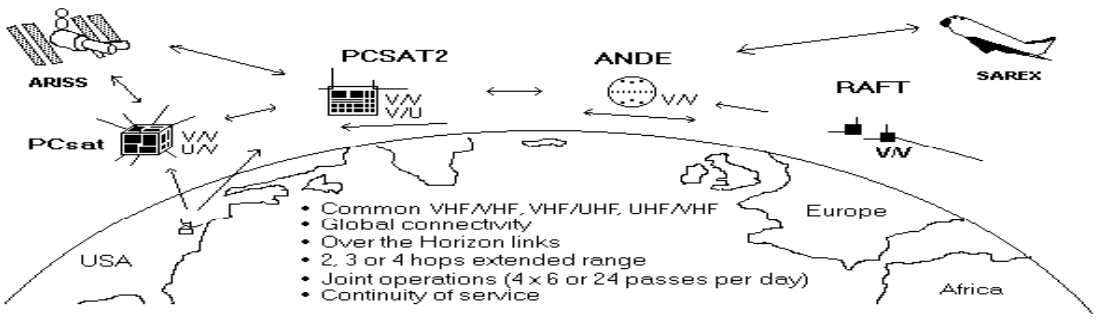
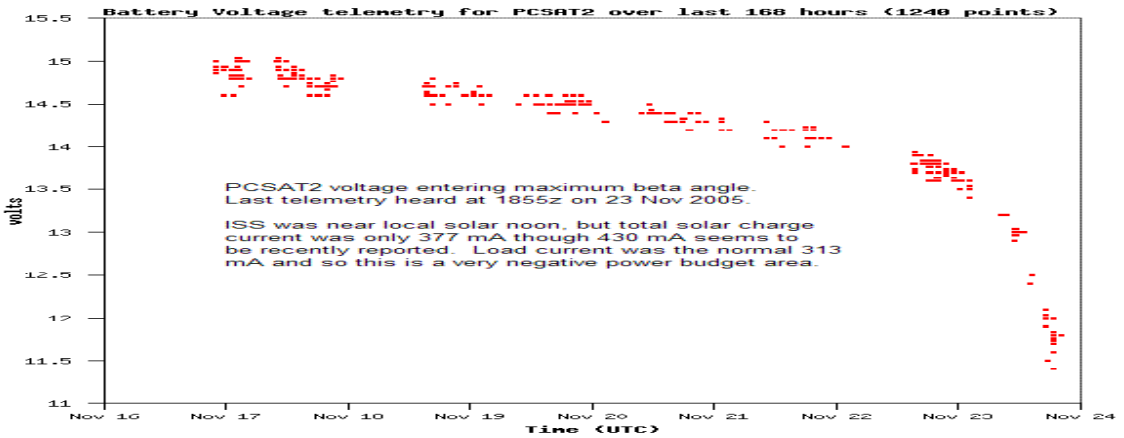
EA467 PCSAT-1 / PCSAT2 Joint Operations LAB (draft) Fall 2005



On Thursday 1 Dec, PCSAT2 will return to operation as the ISS returns to an attitude with PCSAT2 facing the Sun. (PCSAT2 had shut down on 23 Nov due to low power when the Beta Angle exceeded 75 degrees and there was insufficient power to keep it alive. Here is the plot of that loss of power:



But when PCSAT2 wakes up, it will find that PCSAT-1 is also back alive and both operate on the same frequency. This allows us to do a unique experiment of dual-hop communications with both satellites as constellation. This is a very dynamic situation with both satellites going in-and-out of view of each other around the world over the next 3 weeks of potential dual ops.

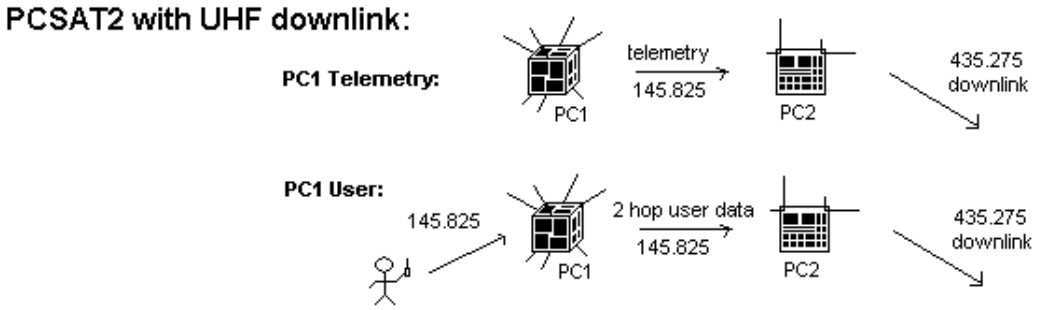
YOUR MISSION: This is not an exercise. Your job is to find all the opportunities when both satellites are in view of each other – and users to use them.

FOOTPRINTS: Because the success of this experiment is totally geometry driven by the population densities of users in the footprint, we need to know dual hop opportunities from a variety of locations where all the users are located. Divide up into groups of two and each group select a location from this list:

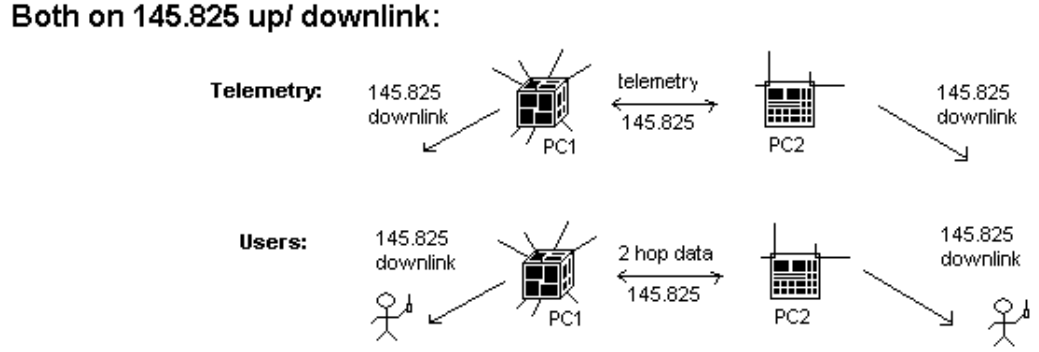
Washington State,	San Diego,	New York,	Florida,	Hawaii,
London,	Rome,	Japan	Canary Islands	
Brazil,	Sydney,	NZ,	South Africa,	Japan,

Set up your scenarios so you can capture all opportunities. Your product will be a TEXT file for your city listing the TIME and a good description of the potential scenario of each opportunity.

BACKGROUND: PCSAT-1 operates as a simplex relay with both the uplink and downlink on VHF 145.825 MHz and is ready to go as a node in a multi-satelltie constellation. PCSAT2, in order to avoid interference with the existing crew downlink on 145.800, had to normally operate with a UHF downlink. Thus in its default mode, it can only operate one direction with PCSAT-1 as shown:



Notice that PC1 can be over the horizon, but we can hear its telemetry via a one hop link via PC2. Or we can hear any PC1 users via 2 hops. The advantage is that the PC2 downlink does not collide with any PC1 user uplinks. But the disadvantage is that PC1 cannot hear PC2. But if we avoid any scheduled school contact with the ARISS system, we can re-configure PC2 to also downlink on its VHF transmitter on 145.825. This makes both satellites bi-directional to all users and telemetry as shown below:



The problem here is that users (who cannot hear each other) will probably be overloading the 145.825 uplink so badly that one satellite will not be able to hear the weak signal from the other satellite most of the time and so it will be rare to hear these cross linked packets without collision. The best opportunities will be when one or both satellites are out over the ocean and the fewest users are in the footprint.

SUCCESSES: Look for successful 2 hop passes on the live PCSAT-1 and PCSAT2 pages on FINDU.COM. Look for any hops that went via the other satellite PCSAT-1* or PCSAT2*.

Resources: The following web pages and resources are available to assist you. STK will be your primary tool. Make sure you have current orbital elements and confirm your time accuracy compared to http://www.heavens-above.com. Start with now, today, and work your timeline forward through 31 December. These web pages may be helpful.

- PCSAT2 OPS PAGE: http://www.ew.usna.edu/~bruninga/pec/pc2ops.html
- PCSAT2 Live Telemetry: and Telemetry plots. See links on the above page
- PCSAT-1 LIVE page: http://pcsat.aprs.org
- CelesTrack Elements: http://celestrak.com/NORAD/elements/
- ARISS Operations: http://www.ariss.net
- ISS Tracking page: http://heavens-above.com