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| Subject | CubeSat to carry 14 MHz Beacon | | |
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| Author: | Hans van de Groenendaal, ZS6AKV | | |

**Background**

Students at the Cape Peninsula University of Technology (CPUT) will build a second satellite; the first is under construction and will be ready by October 2011. This time it will be a single 10 x 10 x 10 cm CubeSat with a mass of one kilogramme, in addition to the larger 3 unit CubeSat. Francois Visser of CPUT announced this at the South African Space Association conference held in Cape Town in September 2010. The single CubeSat will be dedicated to the South African National Space Agency Space Science (previously known as the Hermanus Magnetic Observatory - HMO) science payload supporting the SANSA operations in Antarctica (SANAE IV, Vesleskarvet, Antarctica S 71.68 W 2.85). The main payload will be a transmitter on 14 MHz, generating a signal that will be used for optimising the SuperDarn (super dual auroral radar network) HF radar system.

The SARL has consulted with Martin Harrison, G3USF, the IARU Beacon Co-ordinator, for a suitable frequency to use onboard the CubeSat. It has been agreed to make use of 14,099 MHz.

**What is the SuperDarn project?**

Radar is more than air traffic control and tracking ships at sea, and space isn't as empty as you might think. The Earth and the neighbouring planets of the solar system are inside the heliosphere, the area of space that is strongly influenced by the sun. The heliosphere is filled with solar wind, an electrically charged gas made up of the remnants of the solar atmosphere that streams past the Earth at about 400 km – travelling further every second than the fastest Formula 1 racing car moves in an hour

The electrically conductive upper layer of the Earth's atmosphere (known as the ionosphere) sometimes connects directly to the solar wind. If there is a strong coupling then there is an increased chance that the space environment immediately surrounding our planet will be disrupted – the fast-moving solar wind blowing past Earth can drag the polar ionosphere with it. Scientists use the SuperDARN radar system to measure the ionosphere's movement above the polar cap by detecting echoes reflected by patches of electrically charged particles over hundreds of kilometres above the Earth's surface.

Research in this area reveals the natural coupling between the Earth and the interplanetary environment, including the processes responsible for the mysterious northern and southern lights and some possible links to climate change. However, in our increasingly high-tech society, space research is an important research area be-

cause some modern technologies, both in space and on the ground, are vulnerable to rapid changes in the space environment known as "space weather."

**Why a satellite signal?**

As with all radio systems, phase characteristics change with time. The phase path through the system needs to be regularly calibrated and this can be achieved by introducing another signal into the system, then measuring the emerging phase characteristic.

Dr. Lindsay Magnus, ZS1LGM, who is responsible for the SANSA SuperDarn system said that they are planning to put a transmitter on a CubeSat, which will orbit some 500 km above the earth. "As the CubeSat passes over the Antarctic it will be in full view of the radar antennas. We will then measure the signal and determine what the phase difference is. It will allow us to calculate where the signal is coming from. As we know the orbit and precise position of the satellite, we can take the difference between the calculated position and the known position of the satellite at that time and use that as a characterisation of the phase path through the system. Ultimately it will help us to calibrate the radar system."

"If we can prove that this works, then all 17 SuperDarn systems around the world will be able to use the signal from the CPUT satellite to calibrate their systems."

*CPUT students working on the 3U CubeSat will have an opportunity to work on the HMO science project and a single CubeSat.*

http://active.cput.ac.za/fsati/public/index.asp?pageid=956

http://superdarn.jhuapl.edu/

http://en.wikipedia.org/wiki/Super_Dual_Auroral_Radar_Network