

Semiannual Project and Activity Review June through December 2009

**Table Mountain Field Site, Longmont, Colorado
Haswell Site, Haswell, Colorado**

The second half of 2009 has DSES operating under a renewed, but remarkably different Cooperative Research and Development Agreement with the Institute for Telecommunication Sciences, National Telecommunications and Information Administration for Table Mountain in Longmont. Our former CRADAs were for five-year periods at \$1.00. The new CRADA has us paying \$3,000.00 for a one year period. Congratulations to all DSES members for helping raise the funds for the renewal. While our Haswell dish is still not operational, substantial planning occurred aimed at bringing it online.



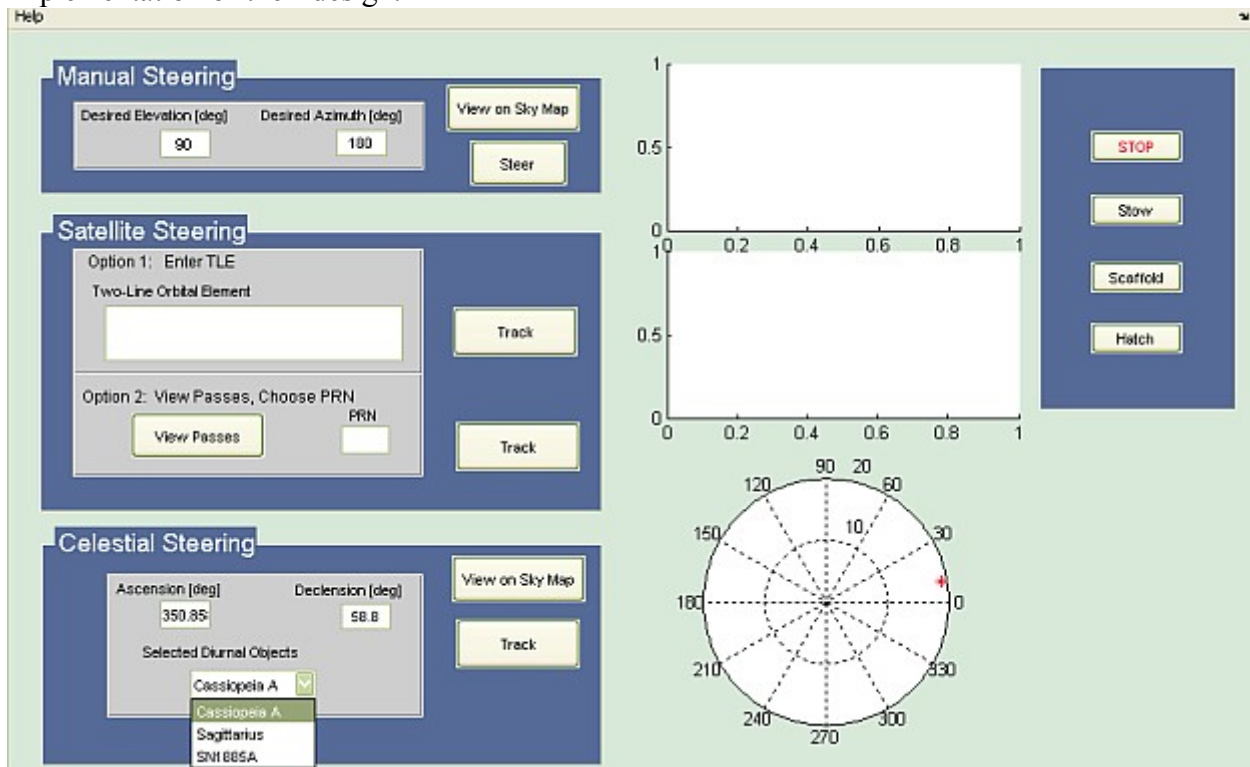
Collaborations with both the University of Colorado Department of Aerospace Engineering (CU) and with the Institute of Telecommunication Sciences (ITS) continued and intensified. DSES members worked with the Front Range Community College, Boulder Campus faculty to inaugurate a small radio telescope as well.

Dennis Akos, Oskar Isoz, and Steve Wilson spent many hours at T22 recording GNSS data and continuing to fine tune the upper dish computer controller begun by Jake Niece and Albert Wu. One such GNSS ([Global Navigation Satellite System](#)) characterization occurred with

Steve and Oskar at T22 controlling the upper dish while Dennis was at the Stanford (Palo Alto, CA) dish receiving satellite data from our upper dish via the internet. It was fascinating watching Dennis manipulate the data recovery computer (in T22) via the internet, which included instant messaging (IM) instructions to Steve and Oskar from Dennis on dish position.

ITS furnished two 16-bit encoders and two synchronous motors to improve the performance of the upper dish. DSES members Peter Goldman and Paul Berge undertook their installation. Paul Berge installed the encoders on both the azimuth and elevation axes. Peter Goldman designed and built circuits to receive and interpret the outputs of the encoders. These encoder signals, captured and conditioned by Peter's translators, provide the position data that supply the CU controller with nearly noise-free position data. GNSS tracking by the upper dish, though still in need of some additional tuning, has been "spot-on."

[COSMOS](#) is an Aerospace Department senior-year student project team at the University of Colorado at Boulder. The primary goal of the COSMOS project is to design, fabricate, and implement a feedback control system for lower dish high gain antenna capable of tracking celestial objects and satellites in earth orbit. This effort requires an antenna pattern characterization, orbital and celestial prediction software, and mechanical analysis and design. CU faculty, DSES, and ITS are some of the intended end users. On December 7, 2009, the COSMOS team presented their critical design review to the CU Aerospace faculty, students, and DSES members Paul Berge, John Ewan, and Jamie Riggs. The team gave an excellent presentation which can be reviewed at [COSMOS](#), (go to Documents, Critical Design, Design Review). We are looking forward to the implementation of their design.



GUI interface with the Lower Dish control system.

The 18-meter lower dish at Table Mountain is currently controlled manually. Thus, the COSMOS objective is to create an integrated control system that will allow safe and easy

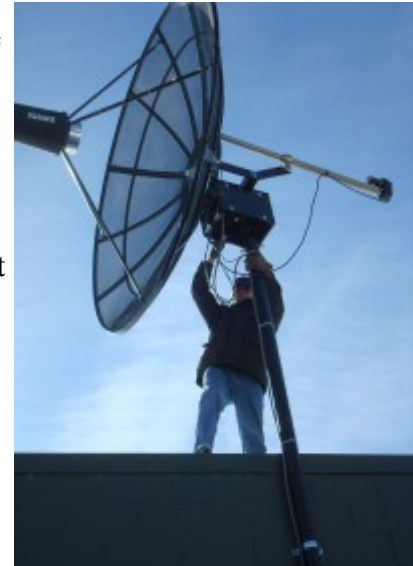
operation of the dish. In addition, several aspects of the mechanical and electrical systems currently in place at Table Mountain will be redesigned and newly added. Once these tasks are accomplished, operators will be able to track celestial objects and earth orbiting satellites through the use of a user-friendly graphical interface. The COSMOS team also hope to have their work serve as a design to be implemented at the dish in Haswell in the future.

Paul Berge and Jamie Riggs collaborated with John Minors to provide an operational radio telescope at Front Range Community College (FRCC), Boulder County Campus, in Longmont, CO. Dr. Minors is the Science Department Chair of the Boulder campus FRCC. He acquired a Small Radio Telescope (SRT) developed by the Massachusetts Institute of Technology (MIT) Haystack Observatory, and supplied by the CASSI Corporation. John assembled the SRT kit and mounted it to the FRCC laboratory building. Paul Berge got the electromechanical systems fully functional while Jamie worked



John describing dish fundamentals to FRCC students.

out the controller/receiver software installation. Thanks to the efforts of John, Paul, and Jamie, FRCC has a fully functional system. Jamie also wrote a simple Solar Laboratory exercise for the students to acquaint themselves with the telescope operation, and with sampling 1.42 GHz signals from the Sun for analysis. Read more at <http://deep-space.org/edu.shtml>.



Paul making final adjustments.

DSES trips to the Haswell site have resulted in preparations for refurbishing the Haswell dish. A door to seal the tower has been fabricated and is planned for installation. Michael Lowe is heading up the planning and project execution in conjunction with Paul Berge.

Ralph Bellamy, Paul Berge, and Rodney Howe have been working on a polarized feedhorn centered at 1,420 MHz. The

system has a computer-controlled switch to change from the horizontal and vertical dipoles. They expect to determine the Stokes parameters necessary for data analysis.

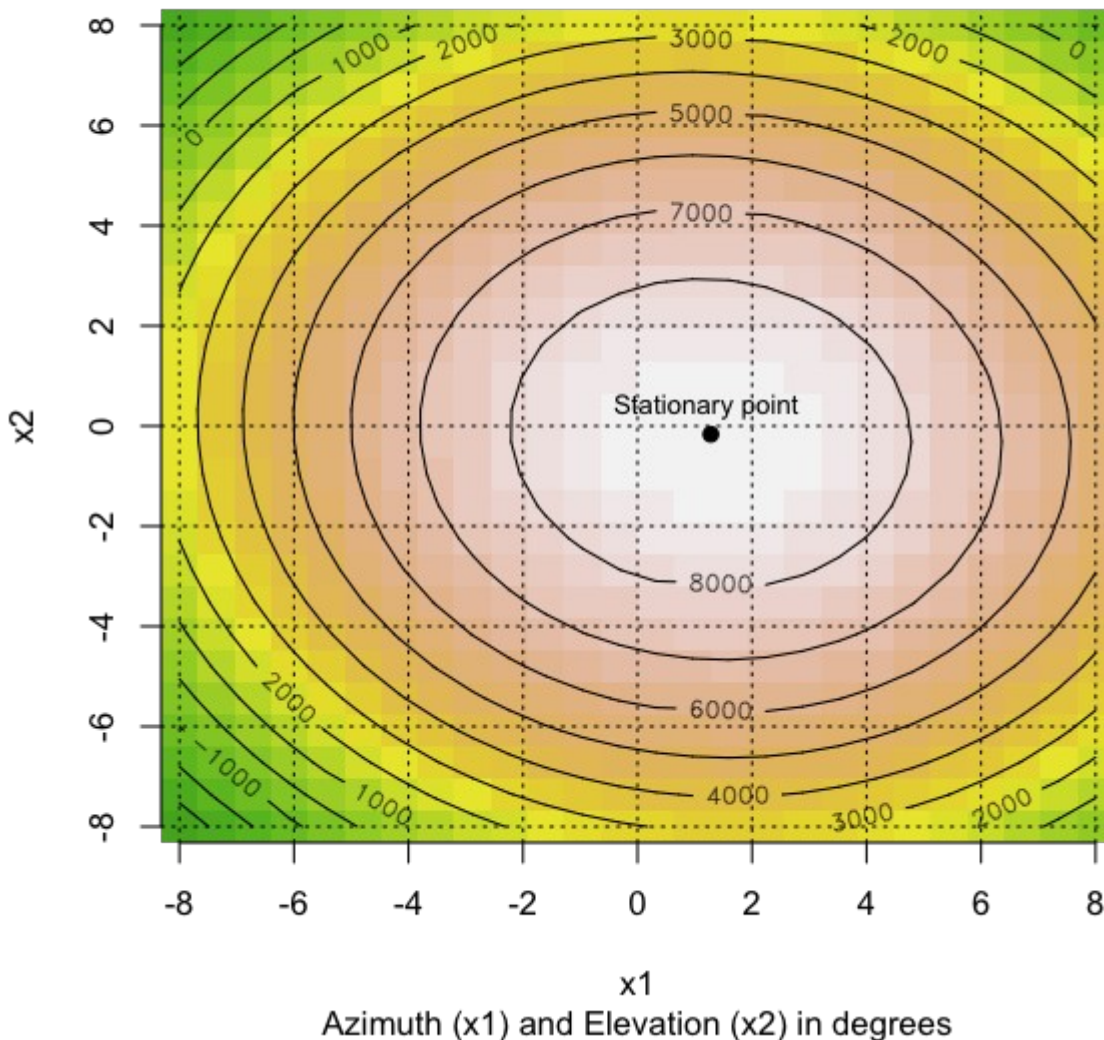
DSES members attended conferences, gave presentations on DSES activities, and published papers. Jamie Riggs was accepted and then attended the Fifth National Astronomy and Ionosphere Center/National Radio Astronomy Observatory Single-Dish Summer School. She wrote a description of her experience that may be found at <http://deep-space.org/edu.shtml#summerschool>.



Jamie working with FRCC students on a laboratory exercise about the Sun.

Rodney Howe and Jamie Riggs had papers published in the Proceedings of the 2009 Conference of the Society of Amateur Radio Astronomers. Rodney's paper is entitled "Work on a Research Project for Galaxy Rotational Doppler Shifts. Jamie's paper is "Comparing the Distributions, Specifically Their Connate Parameters, Resulting from the Selected Additive Combinations of the Real and Imaginary Components of the Signal Spectral Density Function." Rodney's paper can be found [here](#), and Jamie's paper is [here](#). Also, Jamie has a paper entitled "Measurement of SRT Dish Primary Beam Profile" on the Research page of the DSES website located [here](#).

Temperature (K) vs. Azimuth & Elevation Displacements from the Solar Center (0,0)



DSES Organizational Opportunities

The DSES is an organization of amateur radio operators, astronomers, scientists, radio hobbyists and plain old "big equipment" nuts. Whether you like to help with organization and management, work on a keyboard, try to pull in the weak signals, want to try your hand at digital

signal processing or just wonder "what is out there" and you want to see for yourself, the DSES has a place for you.

We still need your help.

The DSES wants to renew its relationship with its members and bring in some new ones as well. In addition to dish improvement projects, we are always looking for projects that use the capabilities of the dish such as radio astronomy, Earth-Moon-Earth (EME), satellite ground station uses, etc.

Do you have something you think we should be adding to our abilities? Come and re-join us! Membership for a full voting member is \$50/year and for an associate, non-voting member is \$20/year.

Thanks to all who have joined or renewed!

Thank you for your interest in the Deep Space Exploration Society!

For further information you can send email to the board members at inquire@dses.org or see our website at www.dses.org. Our newsletter and activity reports are available on this website.

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