

Data Analysis for the Dynamic Ionosphere CubeSat Experiment (DICE)

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Name: Lindsay McTague

Parent Institution: Siena College (Loudonville, NY)

Research Location: ASTRA, LLC (East Boulder, CO)

Mentors: Geoff Crowley, Marcin Pilinski, Irfan Azeem

The Dynamic Ionosphere CubeSat Experiment (DICE) consists of two, spinning 1.5U (10 X 10 X 15cm) CubeSats following one another in a nearly sun-synchronous, elliptical orbit. These twin satellites, named Yahtzee and Farkle, were designed to allow scientists to understand the ionosphere's response to a geomagnetic storm. The objectives of the DICE mission include investigating an important mid-latitude ionosphere electron density structure, known as storm enhanced density (SED), which tends to occur over the United States during geomagnetic storms. In order to achieve these goals, both satellites are equipped with two Langmuir probes placed along their vertical axis to determine electron number density and temperature, four electric field booms to determine the electric field, and a science magnetometer capable of measuring field-aligned currents. The satellites were built and are operated by the Space Dynamics Laboratory and Utah State University.

The DICE satellites were launched on a NASA rocket from Vandenberg Air Force Base in October 2011. The commissioning of the satellites and their instruments has been underway for nine months. All data collected during the mission is downloaded at a rate of ~2 Mbits/s, and put into a MySQL Database, which ASTRA then extracts into its own local database. Data validation and science analysis is done by ASTRA.

After the data is downlinked to its ground-station, it is organized into the days in which it corresponds to (one downlink can have multiple days of data within it). This presentation and poster session will be a review of data plots and analysis that will be utilized to monitor the twin satellites and learn more about the ionosphere. First, a plot of the size of downlink and each day's data content percentage was created to give scientists and engineers an idea of how much data they can expect to see on a certain day. This also gives insight as to whether or not each satellite is functioning properly. The science and general housekeeping data downloaded from each satellite is used to recognize trends and events in the ionosphere, as well as to monitor the health and status of each satellite. To do this, daily plots are created that monitor the temperature of different panels and instruments of the satellite, the current in each part of the satellite, and the Langmuir probe data. The Langmuir probe data can then be compared with the International Reference Ionosphere (IRI) model to validate the satellite data and to monitor space weather effects not captured by the IRI model. This mission will allow scientists to understand more about the ionosphere's storm enhanced density than has ever been known in recent history. Yahtzee and Farkle have expected lifetimes of approximately three years.