Science Background

Light pollution (LP) has a variety of impacts on the natural world from health effects in humans, the disruption of bird migration and other adverse environmental impacts. Light projected into the sky is effectively lost energy. The quantification of atmospheric light can be expanded to wasted expenditure by a community. Careful studies have led to the discovery of correlations between light pollution and social-economic indicators such as poverty, effective energy policy and gross domestic product (GDP). One of the most apparent impacts of light pollution in our daily lives has been the loss of our connection to the night sky, and thus our connection with the Universe. It is estimated 80% of the population of the European Union and the 90% of North Americans cannot see the Milky Way from where they live due to excessive light pollution. As an astronomy, education institution, this has a direct impact on the mission of the Adler Planetarium.

NITESat Mission Goals

The NITESat will accomplish the following goals:

1. Acquire night images of artificial light in a 100km x 100km region centered on Chicago with:
   1.1. a resolution ≤200m/px,
   1.2. a sensitivity ≤0.7 Watts cm² sr⁻¹,
   1.3. RGB information and,
   1.4. Vertical overpass times.

2. Create a network of citizen-run ground-based observing stations (GONet) to provide synthesized observations for calibration and ground truthing of NITESat data.

3. Provide opportunities for students and volunteers to experience the mission for a minimum of 50 students and volunteers per year throughout the mission life cycle.

4. Expose a significant percentage of the Adler Planetarium’s 300,000 visitors per year to information pertaining to the value of CubeSats in general and the NITESat mission specifically through programmatic and mission-related content.


Far Horizons Program Assets

NITESat will be designed as part of the Far Horizons program, Far Horizons is the Adler Planetarium’s hands-on space program. Students and educators work directly with students, amateurs and volunteers in a peer and mentor structure. The program has two years of experience designing and building experiments for High Altitude Balloon missions.

An enthusiastic and dedicated volunteer base is at the core of Far Horizons. In 2015, 37 volunteers contributed over 1,290 hours to the program. Over 300 teachers and students were involved in Far Horizons HAB flights or in the design of experiments for stratospheric flight in 2015. A staff of four full-time and three part-time scientists, engineer, manager and educators provide structure and expertise.

Staff have designed the program to allow multiple entry points based upon participant’s skills. More advanced participants typically act as a mentor training middle to high school level students to perform hands-on experiments. A scaffolded program for teams is used to introduce them to subjects such as electronics, programming, communications and CAD. As their skills grow participants in turn work with higher level projects and assist in the mentoring of new volunteers and students.

Light Pollution from Space

Satellites can provide invaluable data about the quantity and quality of light pollution across the world. NITESat will provide resolution and saturation improvements over OLS’s resolution and more favorable overtimes than VIRS® and spectral data both cannot provide.