

Workshop on Pico/Nano/Micro-Satellite Engineering

(Life cycle of a PNMSat mission, Hands on experience using Classroom Satellite Kit)

Goal/Purpose

The goal of this workshop is to provide an overview of PNMSat Engineering and a roadmap of 3-5 years to successfully start a PNMSat Program and potentially launch an academic satellite. The underlying intent of the workshop is to emphasize the integration of education, research, and development to sustain a PNMSat program at an academic institution.

Objectives

The specific objectives of the planning meeting are as follows:

- Facilitate faculty and students to understand the functions of various subsystems of a PNMSat through hands on demonstration using a classroom satellite kit from EyaSat
- Provide an overview of a typical PNMSat Mission Life Cycle, Budget, Timeline, etc.
- Engage the participants, students, faculty and administration, in initiating a PNMSat program.

The workshop will provide rudimentary hands on training using a classroom satellite kit, which is a functional representative of a PNMSat and demonstrate packet radio communication (Figure 1).

- Electrical Power System (EPS)
- Command & Data Handling (CDH) System
- Tracking, Telemetry, & Command (TT&C) System
- Attitude Determination & Control System (ADCS)
- Structural & Thermal (S&T) System
- Ground Station Communication Emulation



Figure 1 – (a) Classroom Satellite Kit, (b) Packet Radio Communication

Workshop Agenda

To facilitate the above goal and achieve the stated objectives, the workshop is planned in 2 sessions:

Session I

The first session will present an overview of a custom developed Mission Life Cycle for PNMSat, including CubeSat class of satellites and an introduction to the various subsystems of a PNMSat. As part of this session, ham radio communication, including packet radio, exercise may be planned.

- Provide an overview of a typical PNMSat Mission Life Cycle (~45 minutes)
 - Pre-Stage I — Mission Concept and Preliminary Mission Design
 - Stage I — Systems Engineering Training for Mission Execution
 - Stage II — Mission Design, Design Validation, and Virtual Assembly
 - Stage III — Development, Unit/Integration Level Testing
 - Stage IV — Assembly, System Level and Environmental Testing
 - Stage V — Post Launch Operation
- Review of Orbital Mechanics and Overview of Satellite Subsystems (~1 hour)
 - Electrical power system
 - Command and data handling system
 - Telemetry, tracking and command
 - Attitude determination & control system
 - Structural & Thermal System
 - Propulsion system
 - Ground operations
- Overview of PNMSat payloads developed as part of a short course offering (~15 minutes)

Session II

The second session will focus on providing hands on experience in assembly/integration and conceptual operation of a PNMSat using the Classroom Satellite Kit (Figure 2). The participants may be divided into groups to experience Classroom Satellite Kit in an ESD laboratory:

- Gain an understanding of the various constituents of a subsystem (visual inspection)
- Experience the integration/assembly and functioning of the Classroom Satellite Kit
- Experience the concept of ground station to satellite communication
- Telemetry and telecommand operation



Figure 2 – A Typical Hands on Activity Involving the Classroom Satellite Kit