

# EXACT: Experiment for X-Ray Characterization and Timing and High Altitude Ballooning



Luke Zumwalt, Ricardo Saborio, Athanasios Pantazides, Aaron Nightingale

PIs: Dr. Lindsay Glesener, University of Minnesota – Twin Cities, School of Physics and Astronomy

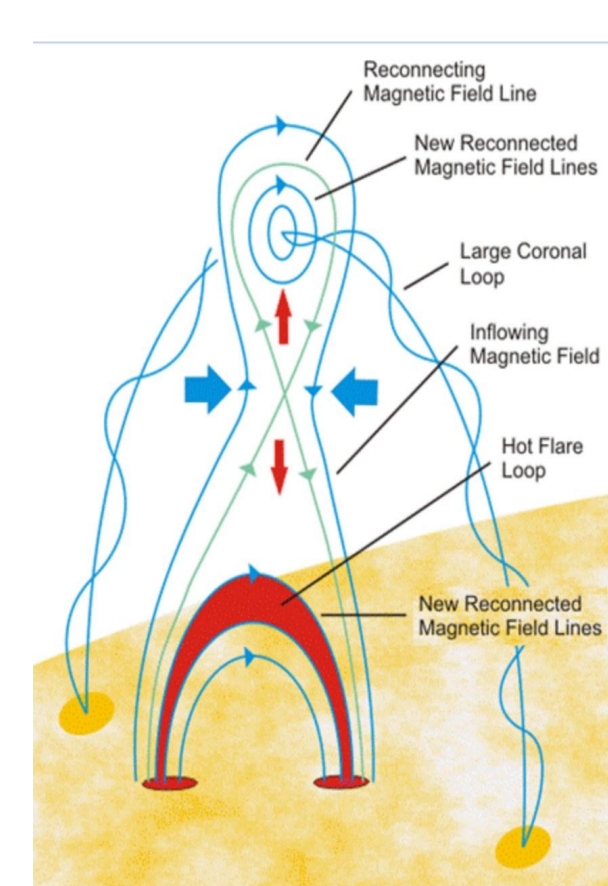
Dr. Demoz Gebre-Egziabher, University of Minnesota – Twin Cities, Department of Aerospace Engineering and Mechanics

## ABSTRACT

A joint effort between the U of MN's Department of Aerospace Engineering and Mechanics and the School of Physics and Astronomy are providing Minnesota with its first satellite, EXACT. Local, University and Professional high altitude ballooning organizations have all played a part in the development and testing of EXACT. Conditions in near-space environments experienced in the lower stratosphere are reachable by helium-filled balloons, so high-altitude balloon missions are becoming a popular form of CubeSat testing.

## PRIMARY MISSION

measure X-ray photon energies and arrival times to study electron acceleration in solar flares, coronal mass ejections, which are

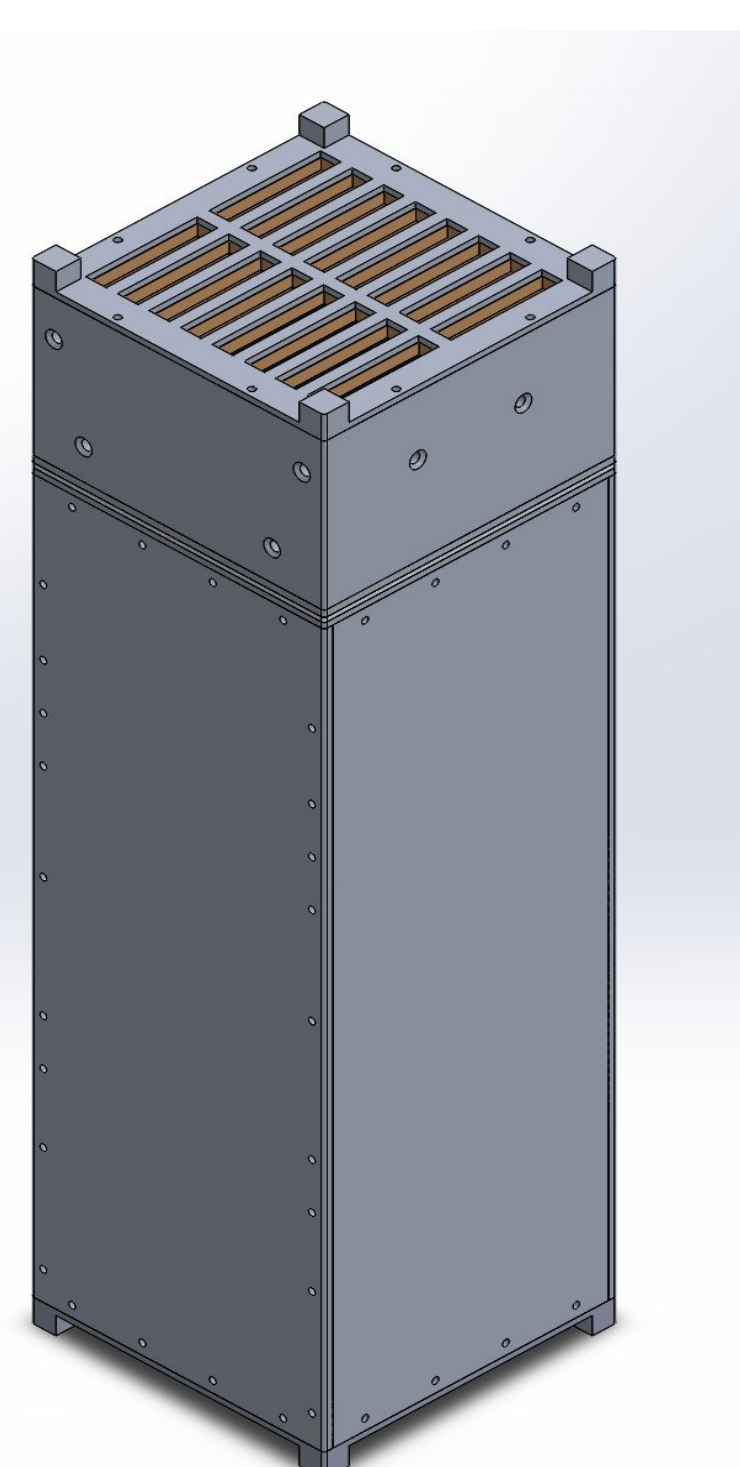


## UMN Ballooning and Cubesats

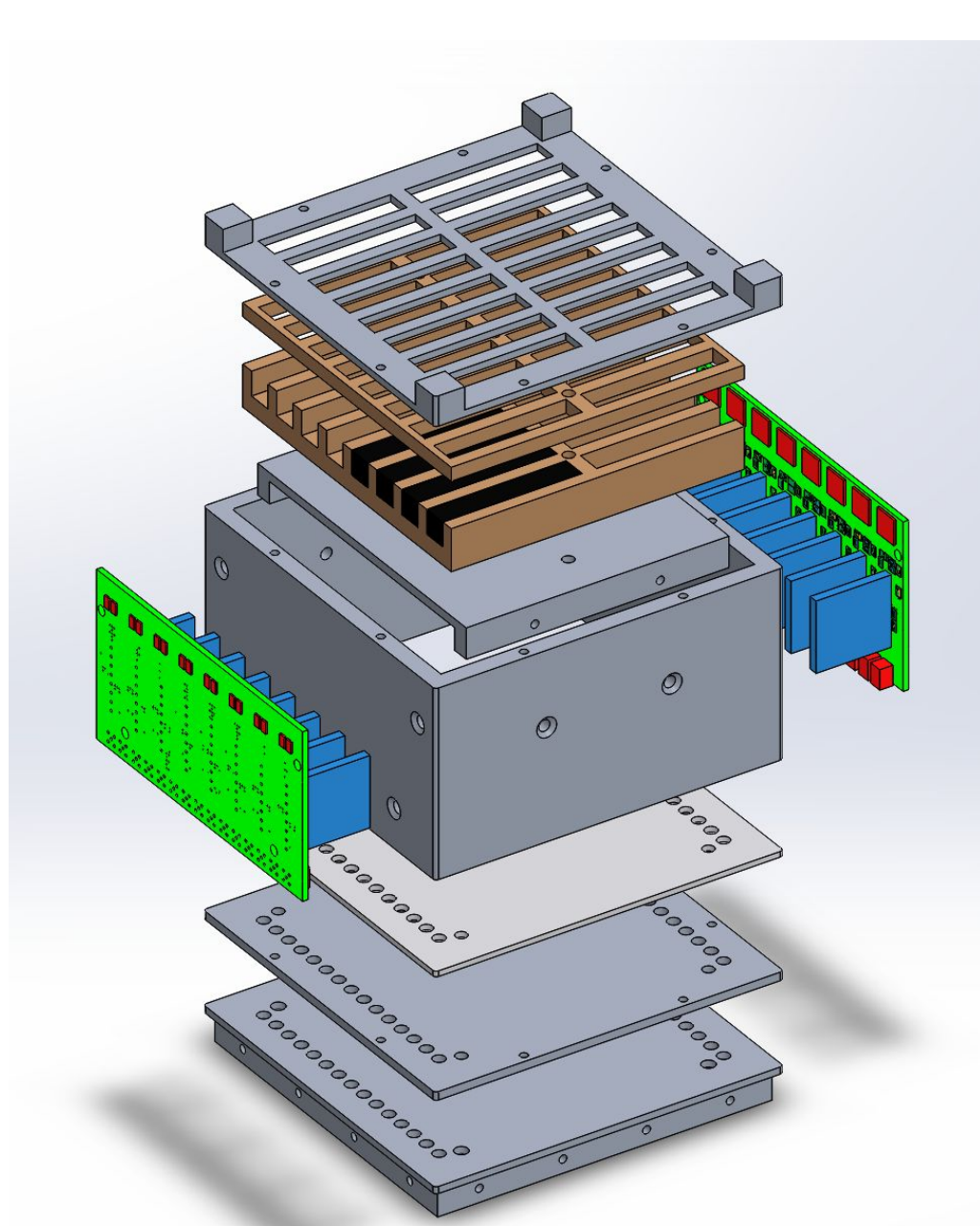


Freshmen seminars and similar programs offered at the University of Minnesota garner interest in hands-on projects. This specifically linked high altitude ballooning and amateur cubesats in a classroom / laboratory setting.

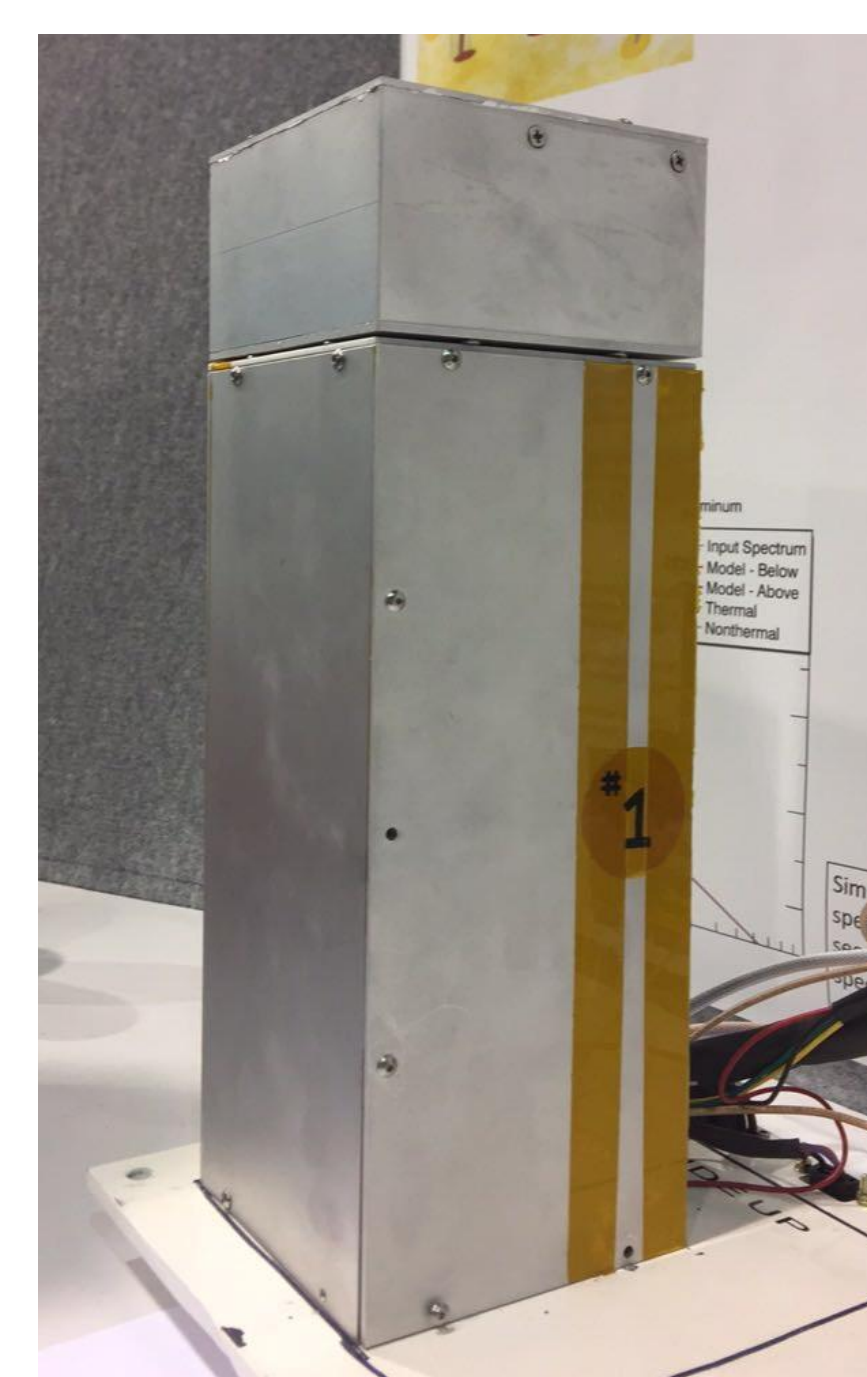
### Enclosed Structure



### Exploded Detector

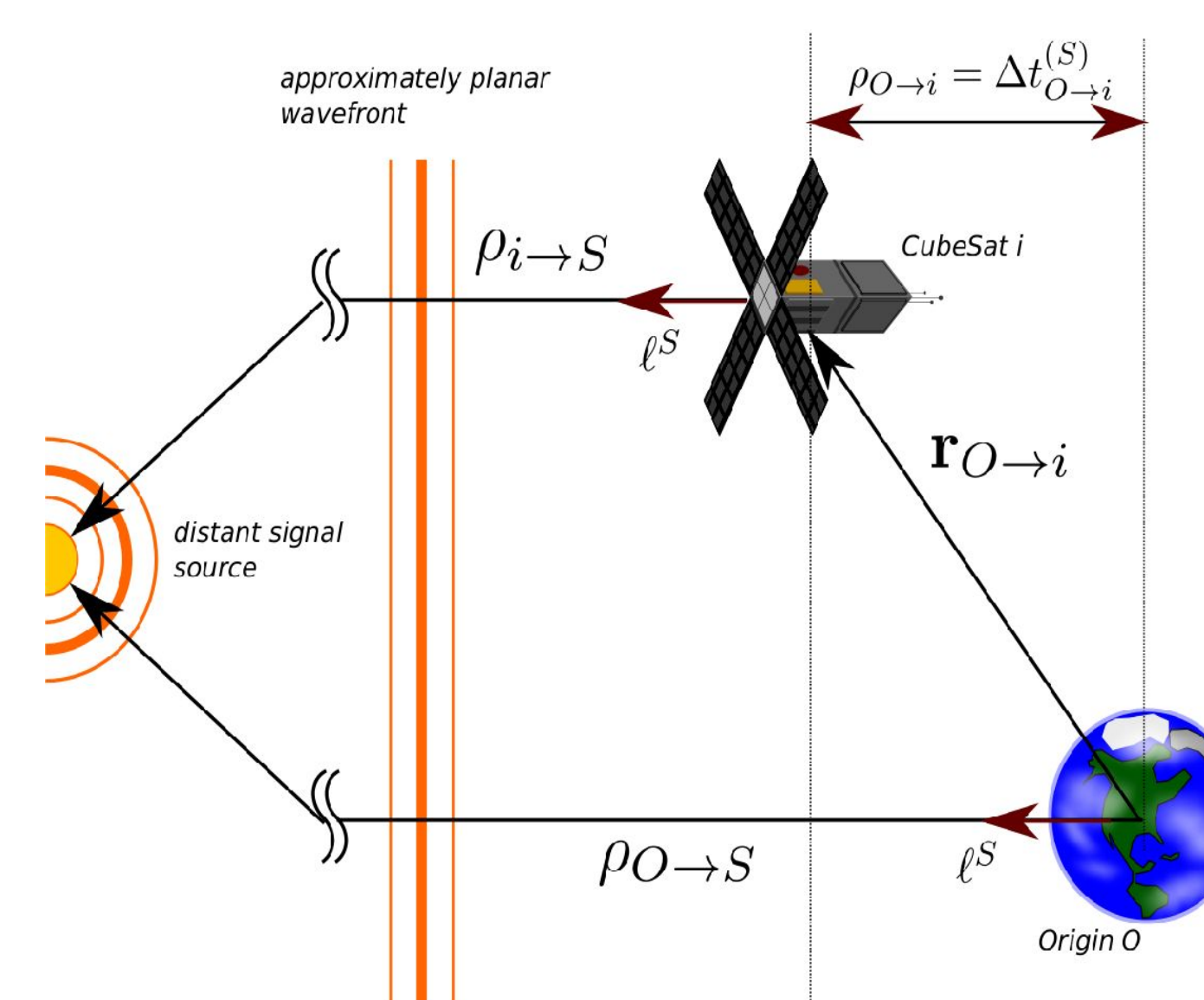


### Current Structure

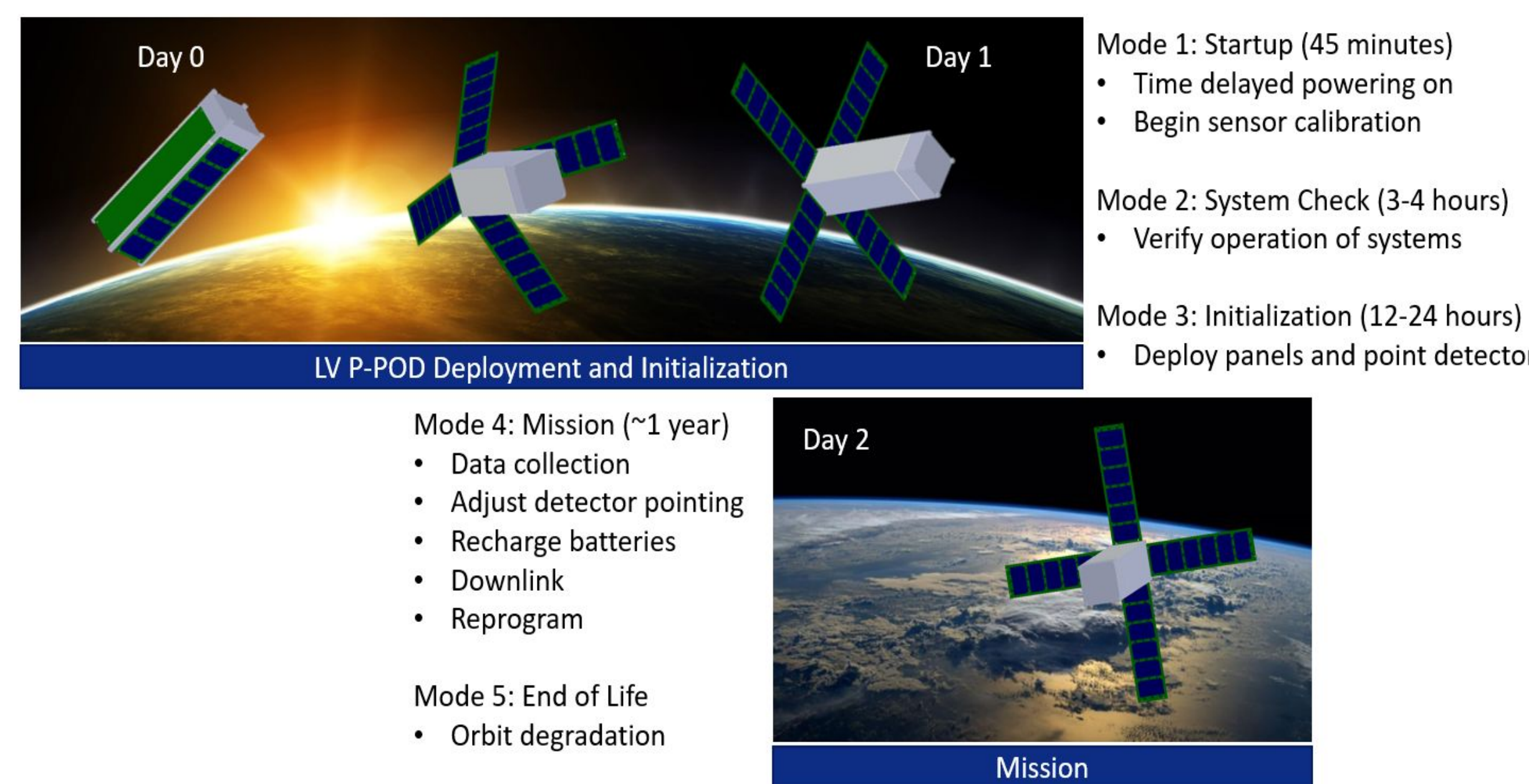


## SECONDARY MISSION

measure the time of arrival of photons, at a known spacecraft position, from astrophysical sources (e.g. solar flares, gamma ray bursts, pulsars) to demonstrate new spacecraft ranging techniques



## Concept of Mission Operations



## High Altitude Student Platform (HASP) Ballooning and Cubesats



HASP provided the UMN Smallsat team with a valuable prolonged exposure to near-space environments essential for testing communication systems and photon detectors. High altitude programs like this are becoming very popular for prototyping and testing cubesats and their components before receiving flight selection.

## Detector Output

This spectrum is using the optimal crystal to photo-sensitive device combination: 5x5mm APD with 4x4x4mm crystal. These photo-sensitive crystals collect energy values and rate of collection of X-ray photons, allowing for calculation of electron acceleration.

