Performance evaluation for pointing control system of the balloon-borne telescope


ENG - Aerospace Engineering

Abstract
The balloon-borne telescope is a planetary observation method launching a telescope to the altitude of more than 30 km by a stratospheric balloon. To conduct the long duration observation, the flight gondola has to equip with a pointing control system in order to catch and keep the target star in the field of view of the telescope during the flight. This research aims to develop the high accuracy pointing control system and conduct the technology demonstration flight. The goal of the pointing control is set as 0.1 arcsec. This paper introduces the results of the ground test and simulation study to evaluate the performance of the pointing control system.
Our team has continued developing pointing-control systems for balloon-borne telescopes. This paper reports the characteristics of our pointing-control system and describes a performance-improvement method for future development.

References (5). Related articles (0). Figures (0). Information related to the author. Supplementary material (0). Result List ().

The Pointing Control System uses two sets of hardware: sensors and actuators. Sensors gather information about the spacecraft’s attitude from the Sun, the stars and Earth’s magnetic field. Actuators physically rotate the telescope to point in a particular direction.

**Sensors.** Five types of sensors make up the Pointing Control System: the Coarse Sun Sensors, the Magnetic Sensing System, the gyroscopes, the Fixed Head Star Trackers and the Fine Guidance Sensors. The system consists of magnetometers and dedicated electronics, which, like a compass, assess the orientation of the telescope. When Hubble rotates, its gyroscopes measure the direction the telescope is turning and the rate of that rotation. Hubble has some of the most accurate and stable gyroscopes ever built. To compete with space telescopes, however, a balloon-borne telescope must also stay aloft for many nights. To achieve this, the team hopes to fly SuperBIT on one of NASA’s new superpressure balloons, which can stay aloft for many weeks. SuperBIT researchers hope to do an observing run in 2021 and are working on a larger, 1.5-meter telescope that they hope will reproduce some of Hubble’s capabilities for a fraction of the cost.

feet, BETTII operates above nearly the entire atmosphere, giving access to this wavelength regime. • Validation of the optical system, including retention of optical alignment through launch and stability of the metering truss. • Demonstration of closed-loop pointing control, using the rotator. While the CCMG was not operational during flight (see below), the momentum dump mechanism was used to slew and brake the payload, achieving stable angular velocities of ~20 arcsec/sec.