THE INTERNATIONAL CONFERENCE ON THE 120TH ANNIVERSARY OF THE BULNAY EARTHQUAKE: ADVANCES IN ASTRONOMY AND GEOPHYSICS

The Operational Status of the OWL-Net Telescope in Mongolia

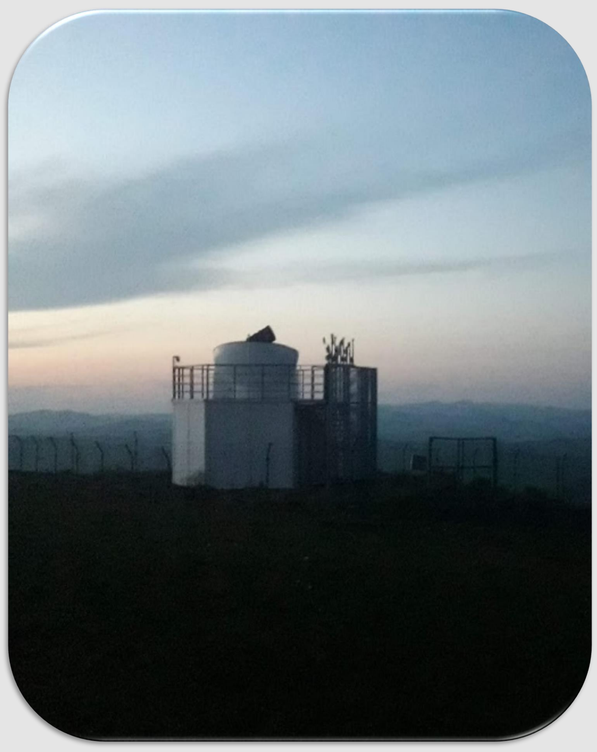
AMARSAIKHAN ZORIGOO
Institute of Astronomy and Geophysics of Mongolian Academy of Sciences
Email address: amarsaikhan@iag.ac.mn

ABSTRACT

Time-domain astronomy has rapidly evolved in recent decades, with increasing demand for real-time, wide-field monitoring of transient celestial phenomena such as gamma-ray bursts (GRBs), supernovae, near-Earth objects (NEOs), and gravitational wave optical counterparts. The OWL-Net (Optical Wide-field PatroL Network), operated by the Korea Astronomy and Space Science Institute (KASI), was designed to address these needs by deploying robotic telescopes at multiple geographically strategic locations. In this context, the Mongolian OWL station, established in 2014 in Tov Province, plays a pivotal role by providing longitudinal coverage between East Asia and Europe.

INTRODUCTION

"OWL" telescope is installed in 55 km from the west of Ulaanbaatar city based on the seismic station within the cooperation between Mongolian Institute of Astronomy and Geophysics, Korea Astronomy and Space Science Institute. It is installed in several countries besides Mongolia. The site, situated at an altitude of 1600 meters with minimal light pollution and over 200 clear nights annually, has demonstrated exceptional performance in both automated operation and data reliability. From 2022 to 2024, the station achieved an average operational uptime exceeding 87%, contributing over 1,500 transient detections to the OWL network. Scientific contributions include real-time follow-up observations of GRBs, tracking of newly discovered NEOs, and support for space situational awareness missions. Technical improvements such as autonomous weather monitoring integration, enhanced remote diagnostics, and power backup systems have significantly increased reliability.



TELESCOPE SYSTEM OVERVIEW

Telescope Type	Ritchey–Chrétien Optical Telescope
Aperture	0.5 meters (500 mm)
Focal Length	~2 meters (f/4 ratio)
Detector	High-resolution CCD camera (4096×4096 pixels)
Mount	Equatorial or Alt-Az fully robotic mount
Field of View:	~2.5° × 2.5° wide-field view
Tracking Speed	Optimized for LEO satellites (7–8 km/s apparent motion)
Shelter	Fully automated sliding-roof observatory
Weather System	Autonomous sensors for humidity, cloud, and wind protection

MOUNT AND DETECTOR

A chopper wheel is employed to maximize astrometric solutions in a single CCD frame, and a de-rotator is used to compensate field rotation of the alt-az type mount. The chopper can split the trail of the moving objects like asteroids and artificial satellites, and also record the time log when the chopper's blade block the time sensor. It makes a CCD image can have many streaks with their own time log. After data reduction, OWL can calculate the orbit of the moving object.

MISSION AND CAPABILITIES

- Optical observation of Low Earth Orbit (LEO) satellites and space debris.
- Key Functions:
  - Automated nighttime tracking
  - Real-time orbit estimation
  - Support for satellite collision avoidance
  - Contribution to international SSA (Space Situational Awareness) initiatives
- Observation Schedule: Up to 300+ cloud-free nights per year

GLOBAL INTEGRATION (KASI OWL-NET)

- Operated by: Korea Astronomy and Space Science Institute (KASI)
- Network Sites: South Korea, Mongolia, USA, Morocco, South Africa, Chile
- Role of Mongolian Station:
  - Covers a strategic longitudinal gap in Asia
  - Enhances global satellite tracking continuity
  - Feeds data to KASI's central processing servers