

The NASA Meter Class Autonomous Telescope: Ascension Island

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ABSTRACT

The Meter Class Autonomous Telescope (MCAT) is the newest optical sensor dedicated to NASA's mission to characterize the space debris environment. It is the successor to a series of optical telescopes developed and operated by the JSC Orbital Debris Program Office (ODPO) to monitor and assess the debris environment in (1) Low Earth Orbit (LEO), (2) Medium Earth Orbit (MEO), and (3) Geosynchronous Orbit (GEO), with emphasis on LEO and GEO altitudes.

A joint NASA-Air Force Research Labs project, MCAT is a 1.3m optical telescope dedicated to debris research. Its optical path and sensor yield a large survey fence at the cutting edge of current detector performance. It has four primary operational observing modes, two of which were not computationally feasible a decade ago. Operations are supported by a sophisticated software suite that monitors clouds and weather conditions, and controls everything from data collection to dome rotation to processing tens of GB of imagery data nightly. With fainter detection limits, precision detection, acquisition and tracking of targets, multi-color photometry, precision astrometry, automated re-acquisition capability, and the ability to process all data at the acquisition rate, MCAT is capable of producing and processing a volume and quality of data far in excess of any current (or prior) ODPO operations. This means higher fidelity population inputs and eliminating the multi-year backlog from acquisition-to-product typical of optical campaigns. All of this is possible given a suitable observing location.

Originally planned for the island of Legan, part of the Kwajalein Atoll Islands, recent developments have led to a change in venue. Specifically, the Ground-based Electro-Optical Deep Space Surveillance, or GEODSS, System of telescopes is the United States' major tracking system for deep space. This network consists of telescopes in Maui, Hawaii; Diego Garcia (Indian Ocean), and Socorro, New Mexico. A fourth optical telescope, though smaller in size, has been operating in conjunction with this effort until recently in Mòron, Spain. With the Mòron site closing, a significant gap in longitude exists between the New Mexico and Diego Garcia sites. This longitudinal gap is well covered by placing a telescope on Ascension Island (7° 58'20" S, 14° 24' 4"W), in the Atlantic Ocean.

Ascension Island offers the benefits of both location and weather. The near equatorial location affords the opportunity to access under-sampled low-inclination orbits and new GEO longitudes, while simultaneously filling in the GEODSS longitudinal gap. Ascension Island is a volcanic, desert island, receiving only 7" of rain per year on average. With consistent trade winds blowing from the SSE direction off Africa, the combination of an island location with consistent winds will create the smooth laminar flow sought after by all astronomical sites, which creates stable atmospheric ('seeing') conditions. Finally, this low population island has minimal lighting, resulting in very dark skies, ideal for an observatory.