Reinventing Space Situational Awareness in Cislunar Space

Abstract: Our current space situational awareness (SSA) capabilities have evolved and matured since originally being developed in the mid-1950s in response to the imminent launch of the first Russian satellite Sputnik. The development of our ground-based space surveillance systems and techniques were led by a coalition of academic and Government organizations to meet the emerging needs to detect, track, and catalog objects in Earth orbit. Early on, the complementary capabilities of optical and radar systems were embraced as a foundational element of our space surveillance network (SSN). Today science, civil, commercial, and military interests are motivating a return to Moon and the unique orbital regime surrounding the Moon and the Earth/Moon Lagrange points. China already has an extensive lunar exploration program, with a lander and rover on the far side of the Moon and a communication relay satellite stationed in an L2 halo orbit. NASA plans to exploit the unique astrodynamics at L1 as a lunar and interplanetary gateway and return man to the Moon by 2024. Commercial interests see a future of providing services and mining products from the lunar Polar Regions. In time, robust Earth/Moon communication relay and lunar-GPS constellations will be deployed. Inevitably cislunar space will become congested, contested, and contested. To ensure safety and freedom to operate in this new domain, space-faring nations must establish foundational surveillance, cataloging, characterization, and space traffic control capabilities. While our nation’s capabilities to maintain awareness in the confines of the traditional orbits out to the geosynchronous belt is mature, we have essentially no capabilities even to detect objects in the cislunar environment. Many of the same characteristics of cislunar space that enable these missions are the same characteristics that make cislunar space a challenge for SSA. The large distance to cislunar satellites compared to circumterrestrial satellites, and difficult viewing geometries make surveillance and detection of cislunar satellites much more difficult. Equally important, the astro-dynamics attributes that allow low-energy transfers in cislunar space and are enabling to the diverse missions proposed are the same attributes that make establishing and maintaining a catalog in cislunar space difficult. These problems are multi-disciplinary problems and offer a new opportunity for the combined talents of academia, our different Colleges, and Government organizations to re-invent SSA in this challenging new domain.

Bio: Dr. Eric C. Pearce joined the Steward Observatory in August of 2016. Throughout his career, his primary area of research has been the development of advanced systems and astronomical techniques specifically optimized for discovering, tracking and characterizing artificial earth orbiting satellites. At the University, he leads a team of students and staff developing new techniques for the characterization of space objects with telescopes as large as the 6.5 m MMT telescope and as small is the 180 mm portable Pomenis Astrograph at Mt. Lemmon. Recently, Dr. Pearce authored the influential plenary study Establishing SSA in Cislunar Space for the Office of the Secretary of Defense (OSD). His current research interests continue to focus on the understanding the technical challenges and developing the techniques and instrumentation to extend our capabilities to surveil and monitor space into the cislunar regime. Before joining the University, he was the Telescope Group Lead at the Giant Magellan Telescope (GMT) in Pasadena, CA. Prior to that, Dr. Pearce spent over 25 years working at the MIT Lincoln Laboratory developing ground-based optical tele-scopes systems for tracking and characterizing satellites for the U.S. Air Force and other Government sponsors. While at Lincoln Laboratory, he was the principle investigator leading the development of the DARPA sponsored 3.5 m Space Surveillance Telescope (SST) —one of the largest telescopes ever built specifically for satellite tracking and space surveillance.

Tuesday, March 3, 2020
AME Lecture Hall, Room S212
Refreshments and socializing at 3:45 pm outside S212