Advancing Distributed Lunar Surface Sensing: Progress and Testing from the Great Lunar Expedition for Everyone (GLEE). E. H. Author[1] and B. S. Author[2], [1]Affiliation: Colorado Space Grant Consortium at the University of Colorado, Boulder, emhe1596@colorado.edu, [2]Affiliation: Colorado Space Grant Consortium at the University of Colorado, Boulder, barbra.sobhani@colorado.edu.

Introduction: The Great Lunar Expedition for Everyone (GLEE) is a student-led research initiative developing a distributed network of centimeter-scale sensor nodes ("LunaSats") designed to collect in-situ data across the lunar surface. The mission architecture seeks to deploy large numbers of small, low-cost sensors capable of measuring regolith mechanical properties, thermal gradients, and localized magnetic fields. Such distributed sensing can support future lunar surface operations, resource prospecting, and environmental monitoring relevant to emerging space resource utilization activities.

At the 2025 Space Resources Roundtable, the GLEE team presented a conceptual overview of the mission and its goal of enabling scalable lunar surface sensing through distributed systems. Over the past year, the project has transitioned toward mission validation through subsystem development, environmental testing, and expanded engineering collaboration.

Recent Development and Testing: Major progress has occurred across several technical areas. GLEE teams conducted deployment and surface interaction testing at the Colorado School of Mines Lunar Regolith Testbed, enabling evaluation of mechanical deployment dynamics and sensor survivability within simulated lunar regolith environments. These tests informed design refinements to the Housing and Deployment Module (HDM) responsible for distributing LunaSats across the surface.

Additional progress includes advancements in avionics integration, communications architecture, and subsystem verification across multiple student engineering teams. Development has continued on the LunaSat V8 architecture, with early work beginning toward the next-generation V9 design iteration. The project has also expanded integration and validation activities to improve system reliability and readiness for future flight testing.

Flight Testing and Future Milestons: GLEE is advancing flight heritage through participation in the NASA RockSat-X program, with a planned suborbital launch from Wallops Flight Facility in June. This mission will test key deployment and communications technologies in a microgravity environment, providing critical validation data for the broader lunar mission architecture.

Looking forward, the project will expand testing and educational outreach initiatives, including the Global Sensor Technology and Engineering Mission (GSTEM) competition. By combining iterative engineering development with distributed student collaboration, GLEE demonstrates how academic research programs can contribute to lunar exploration technologies while broadening participation in space systems development.

Relevance to Space Resources: Distributed surface sensing architectures such as GLEE can provide valuable environmental and geotechnical data needed to support future in-situ resource utilization (ISRU) activities. High-resolution measurements of regolith properties, thermal behavior, and surface conditions are critical for site characterization, excavation planning, and long-term lunar infrastructure development. By demonstrating scalable sensor deployment strategies, GLEE contributes to technologies that may support resource prospecting and sustainable lunar operations.