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Author: Ms. Ariel Ekblaw
Massachusetts Institute of Technology (MIT), United States

Prof. Joseph Paradiso
Massachusetts Institute of Technology (MIT), United States

URBAN PLANNING AT PLANETARY SCALE: ARCHITECTING LOW EARTH ORBIT

Abstract

With humans standing at the cusp of interplanetary civilization in the next decade—from lunar gateways to planned Mars missions—our nearby Low Earth Orbit (LEO) might appear increasingly parochial. Yet, it is this intimate sphere immediately surrounding our home planet, at altitudes from 100mi to 1240mi above the surface, that should inspire the charts and policies of a new generation of urban planners. The next decade of explosive commercial growth in LEO presents a grand opportunity to intentionally design our nearest reaches of space as humanity's first "planned orbit," with explicit international cooperation and multi-stakeholder engagement models for a Space2030 Agenda.

The domain of Low Earth Orbit presents many of the same categorical challenges facing city planners on Earth. A top-of-mind topic for much of the space industry—space debris—mimics the debates over waste management and sanitation in industrializing cities. How can we limit the generation of space waste, effectively regulate the commercial and government sources of space debris, and mitigate the risk that existing space debris poses to satellites and spacecraft? Low Earth Orbit also raises questions of "land use" and zoning—how will we regulate space hotels near off-world microgravity manufacturing centers? Similar to urban resource management of common utilities (water, electricity, etc.), we already face resource constraints (e.g., radio frequency band allocation) and a need to actively mediate the tragedy of the "space commons."

These many dimensions of space urbanism, familiar to us while also unique to the challenges of the space environment, call for a holistic approach to LEO planning. To this, we must bring the global, shared perspective and coordination across countries that brought us the International Space Station and the many jointly-architected space probe and exploration missions. This paper proposes that through an urban planning framework, we can begin to realize the next wave of expansive space industry growth, LEO community building, and multi-stakeholder governance that should underpin an infrastructure planning challenge at this scale. Fundamentally, Low Earth Orbit is not a Wild West-like frontier. The decisions we make in the socio-political, economic, and architectural foundations of Earth's near-space cocoon will directly impact daily life on the surface—from whether we allow LEO advertisements to crowd the skies, to whether we effectively empower citizen science and democratize access to near-Earth satellite technology. We need intentionality and coordination—a spirit of democratic, concerted planning and preparation that can evolve with us as we humbly extend our human presence into space.