Space Is Poised for Explosive Growth. Let's Get It Right.

Before low-earth orbit is clogged with hotels, satellite traffic and debris, we should plan for the extra-planetary community we want, writes Ariel Ekblaw, founder of the MIT Media Lab Space Exploration Initiative

By Ariel Ekblaw
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In the 19th century, urban planners wrangled the chaotic metropolises of Paris and New York into "planned cities," turning warrens of streets into orderly grids, building sewage systems and transit lines, and allowing for new types of architecture, such as apartment buildings. Today, we face a similar inflection point in developing the nearest reaches of space.

The next decade is set to bring explosive commercial growth and more private industry players to low-earth orbit, the area spanning 100 to 1,240 miles above the planet's surface. SpaceX has proposed a satellite-based internet, and Planet is growing its fleet of Earth-imaging satellites. NASA plans a transition towards commercial management of the international space station. Several startups are developing low-earth orbit advertisements—logos or other designs, visible in the night sky, made from tiny, reflective satellites. Entrepreneurs are making plans for space hotels.

Before we let rampant development go unchecked, we should consider how these efforts might conflict with or complement each other. We still have the chance to intentionally design humanity's first "planned orbit."

In some ways, the challenges in space mimic those facing city planners on Earth. In the 19th-century, urban planners built systems for waste management and sanitation in industrializing cities. Today, we need to mitigate the risk of "space debris"—spent rocket stages, fuel tanks and decommissioned satellites that could damage other satellites, spacecraft and future human habitats. Several startups are developing solutions, including capture nets, "chaser and target" propulsion units that would force debris back to earth, and the repurposing of empty rocket stages into habitats. In November, the Federal Communications Commission voted to review and revise their satellite deorbiting rules, first adopted in 2004, to make them more stringent. To limit the creation of new debris, regulators around the world are addressing "deorbit plans" that

require certain classes of launched objects to prove they can successfully burn up on reentry.

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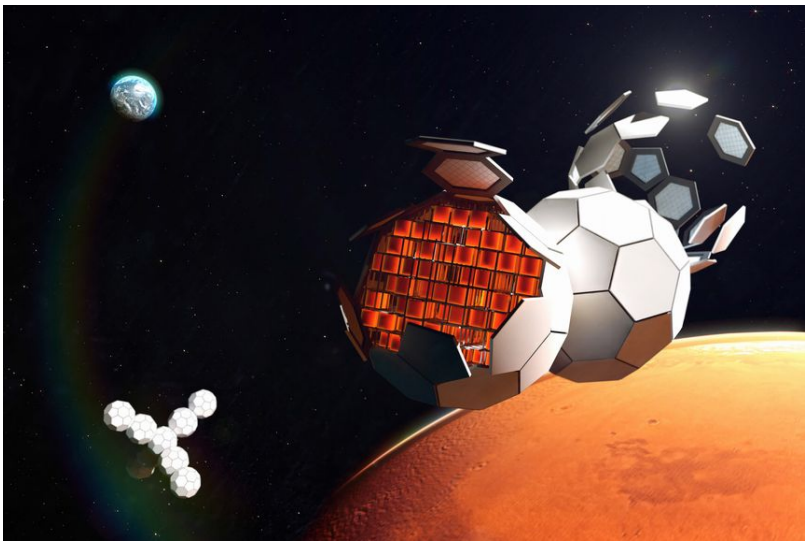
Low-earth orbit also raises questions of "land use," zoning and shared utilities. One day, off-world manufacturing centers might take advantage of microgravity to make things like improved silicon wafers. Just as on earth, there are potential risks—like explosions and pollution—if facilities are built too close to habitats. Should we preserve swaths of orbit for scientific use in the same way we allocate land to national parks? Distances in space are vast, but we still need to manage shared-orbit traffic and satellite congestion. This is being addressed in part by bodies like U.S. Strategic Command, which tracks space objects for satellite operators, and the United Nations Office for Outer Space Affairs' register of objects launched into outer space.

Just as regulators oversee common utilities like water and electricity, in space we are allocating shared resources like electromagnetic spectrum, which impacts the availability of radio frequency bands for space-based communication. The FCC and the International Telecommunication Union currently regulate this in the U.S. and globally, respectively.

Future low-earth orbit cities will also need reconfigurable architecture that can assemble autonomously—to avoid dangerous and costly construction by humans—and adapt to the needs



The MIT Media Lab Space Exploration Initiative is developing a system of self-assembling modular tiles called Tesserae, which lock together using magnets to form a geodesic dome. PHOTO: TU DORTMUND FRAUNHOFER INSTITUTE

of changing missions and the desires of inhabitants. At MIT, we're developing a system of self-assembling modular tiles, called Tesserae, that lock together using magnets to form a geodesic dome. The idea is to create low-cost, reusable modules that can be used as orbiting bases, small-scale habitats, space getaways or other infrastructure for life in space. Freed from the constraints of Earth's gravity, we can redefine how we design and build architecture.

As low-earth orbit's population grows from three crew members aboard the international space station to potentially millions of people living and working in space, the economic, architectural and socio-political decisions we make about what happens in near-space will directly impact life on the earth's surface. Will we allow floating advertisements to crowd the beauty of the cosmos, and possibly prevent astronomers from studying stars and galaxies? Will we make it easy for "citizen scientists" to access and use satellite technology? To answer these questions, we need a new generation of "space planners" and "space architects" who can thoughtfully adapt the principles of communal life on Earth to our nascent lives in space. We need to embark on this next wave of growth with a focus on community building—the same kind of cross-country coordination that brought us the international space station, a triumph of engineering, continuously inhabited for 18 years and counting. We need a spirit of democratic, coordinated and intentional planning—that evolves as it goes—as we humbly extend our human presence into space.

Ariel Ekblaw is the founder and lead of the MIT Media Lab's Space Exploration Initiative, a team of over 50 graduate students, faculty and staff building technologies, tools and human experiences for a future in space.