

What's on the horizon for space

Dramatic changes in the Earth's climate are certain to drive humanity's search for alternative fuel sources. As the accelerating advance of technology extends our reach farther into the cosmos over the next 100 years, we may set out to seek these alternative fuels in space.

Colonies, refineries, and even powerplants on the Earth's moon could collect the helium required for nuclear power. Satellites orbiting the Earth, the moon, and other planets could remain aligned with the sun to collect power from massive solar arrays, and either energy source could then be projected to Earth's other colonies via microwave or laser upon alignment with static ground receivers. Similar structures could provide a steady source of energy to spacecraft, space-station modules, and prefabricated buildings, aiding long-range travel and population of bodies such as Titan and Mars.

Space travel itself will doubtlessly be much more safe, economical, and prevalent. Advances in electromagnetic railguns could lead to massive ramp-like linear accelerators replacing launch vehicles, a far less dangerous and less expensive operation than current rocket-propelled methods.

Travel in space will certainly be aided by solar sails—huge, delicate structures that use the sun's energy like wind. Advances in composites, ceramics, and nanotechnology will yield materials for spacecraft skins that will lead to a dramatic reduction in maintenance time and costs. Aircraft that utilize aerostatic forces—such as the flow of air around a falling object—may allow solid, high-altitude platforms with virtually limitless power, like floating spaceports that decrease the time required for launch and re-entry of spacecraft.

These sorts of facilities may even replace commercial airports, decreasing transit time for passengers by taking flights into orbit. Cheaper, safer, reusable spacecraft with renewable power sources would make the world seem a smaller place, placing reliable long-range travel within the means of more and more people. It is even

possible that structures could be built in orbit to project and maintain tracks of material or energy for a system similar to an orbital train. Lifts could be combined with space elevators, using solid material, magnetic fields, or even forms of light, with the result being that one could step onto a lift in New York City and step off moments later in Tokyo. Such a structure could also form the scaffolding for orbital cities, further increasing the carrying capacity of Earth and other populated planets. And just imagine the view.

The new accessibility of space would have countless applications in defense as well. Space-based weaponry could protect nations from meteor impact and intercontinental ballistic missile strikes, and even provide early warning and defense against incoming aircraft or ground forces. Mobile or static space structures may serve the purpose of firebases, supply depots, barracks, aircraft carriers, and communications and surveillance satellites all in a single modular unit. Invasions, terrorist attacks, riots, or other disturbances could be engaged and contained by air and ground forces in a matter of moments, extending the reach of military strength or law enforcement well beyond the horizon.

As with all maturing technologies, satellites will become cheaper, easier to produce, more robust, and quicker to deploy. The result will be a veritable flood of new information, fueled by unlimited, free bandwidth. We will be able to constantly monitor changes in our environment to determine trouble spots such as developing storms or vulnerable points in the ozone layer. Access to news and information will be cheap and ubiquitous, making it more difficult for oppressive regimes to control people through ignorance, while quickly transmitting different viewpoints around the globe.

The sky is clearly not the limit in terms of space development, and if history has taught the human race anything it is that the events of the future rarely unfold exactly how we imagine. In 1905, commercial aviation was the stuff of science fiction, so the world of 2105 will most certainly be a place of wonder. **AE**



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The opportunities for space are literally limitless, from space stations...



...to lunar bases that can travel on wheels or legs, and not just in artists' conceptions but in engineers' minds.