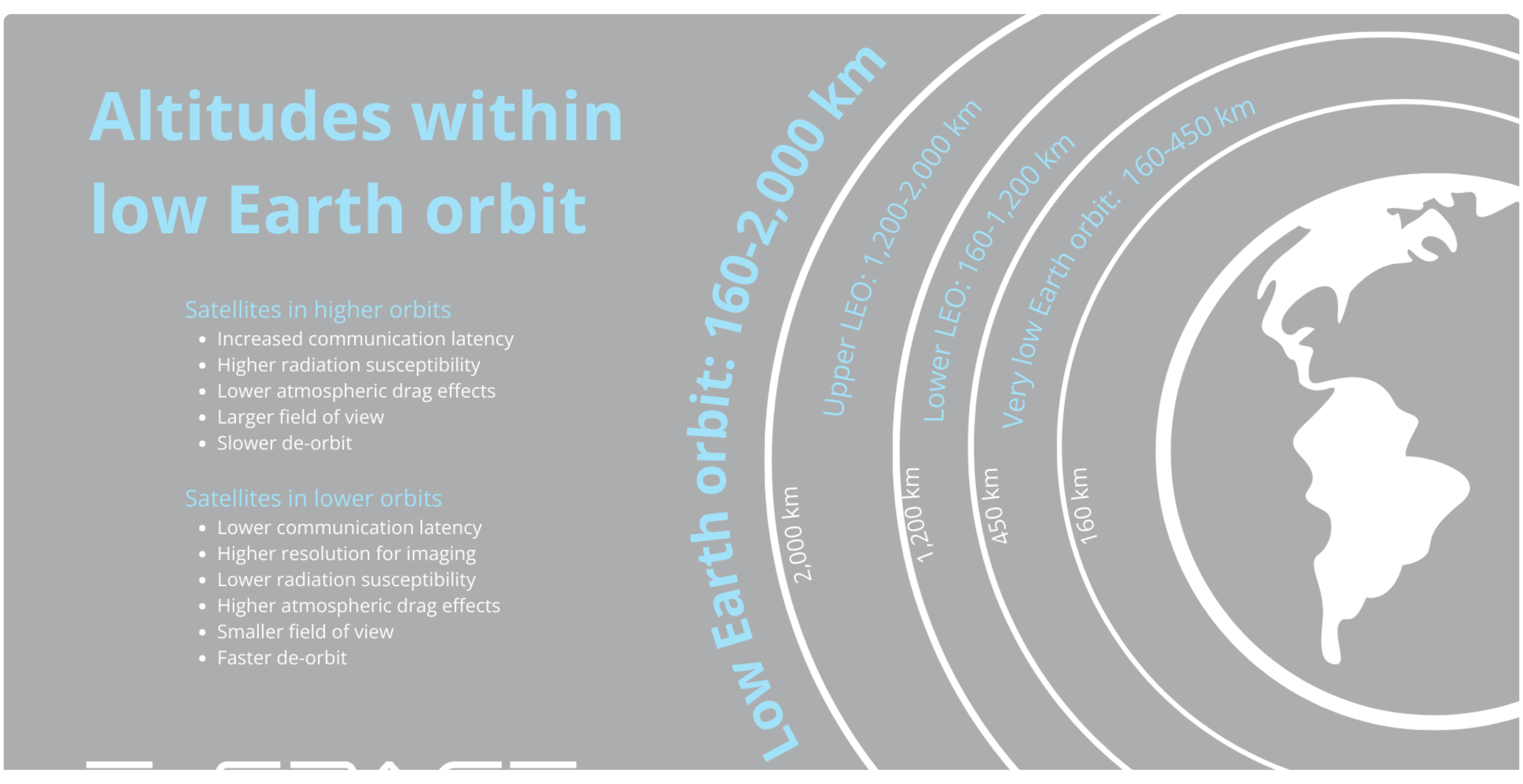
2-Minute Tech: Exploring different altitudes within low Earth orbit

Alex Miller 2 minutes
Technology



From 160 km up to 2,000 km, each section has particular attributes — and challenges

More than half of all the artificial satellites orbiting Earth are in LEO — or low Earth orbit. LEO is generally defined as ranging from about 160 km up to 2,000 km, but within that range there's still some further refinement based on altitude.

Lower LEO extends from 160 km to 1,200 km, and withing this range is **VLEO** — very low Earth orbit — from 160-450 km. For satellites with Earth Observation (EO) missions, the proximity to the planet's surface is beneficial since optical cameras can zoom further in with finer resolution, and the signal from synthetic-aperture radar (SAR) imagers, temperature imagers and the like have less distance to travel.

The International Space Station is in this lower portion of LEO, as are some optical and communications satellites. Latency — the amount of time it takes for a signal to travel from Point A to Point B — is lower the closer the transmitter is to Earth, so lower LEO is ideal for communications satellites and EO satellites to capture higher-resolution images.

The challenge of this lower orbit is that satellites will experience more atmospheric drag, since this altitude range falls within the upper layers of the Earth's atmosphere. Upper atmospheric molecules impact the satellite's orbit, necessitating more frequent orbital adjustments to prevent the satellite's orbit from decaying sooner. This is part of the reason why LEO satellites are typically short-lived once the satellite propulsion fuel, which keeps it in orbit, is consumed.

In **upper LEO** — from 1,200 km to 2,000 km — there's less atmospheric drag. That means less frequent orbital adjustments and longer orbital life, but also more exposure to cosmic radiation that can impact the spacecraft — particularly its avionics.

Lower latency is a big plus in LEO, but the closeness to Earth also means the satellite can only "see" a small part of the planet's surface — whereas a geostationary orbit satellite at 36,000 km can view a full third of the Earth's surface.

That small field of vision is why LEO satellites with more global missions require more satellites to provide full Earth coverage. LEO constellations using inter-satellite links can both cover the planet and route data more efficiently from one satellite in the constellation to another, and eventually to Earth ground stations through any of the satellites passing over any given ground station.

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Alex Miller leads editorial at E-Space. Based in Denver, he's a longtime journalist who's been involved with the satellite industry for over a decade.

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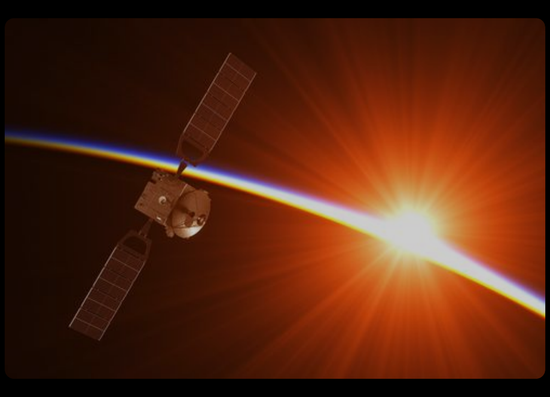

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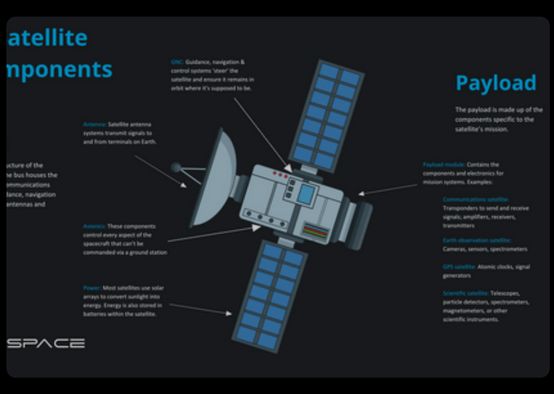

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