

In 2009, two communications satellites accidentally collided, destroying each other. This created thousands of pieces of space debris that have threatened the International Space Station and other uses of space. And orbital lanes around Earth were already congested with hazardous waste. Based in Tokyo, space startup Astroscale is boldly developing technologies for an unprecedented mission: to clean up orbital junk and ensure the sustainable use of space.

and selected Tokyo as its new headquarters, and then, in 2022 the enterprise was named as one of the world's 100 most influential companies by *Time*.

"Japan is a country where rockets are launched, satellite parts are produced and ground stations handle data transmission for operations," says Ito. "That makes it very easy to carry out space development. Tokyo is one of the best places for obtaining financing and working with experts at universities. Our CEO's

# Making Space Sustainable

Earth's backyard is littered with junk.  
Tokyo's Astroscale has a plan to clean it up.

by Tim Hornyak

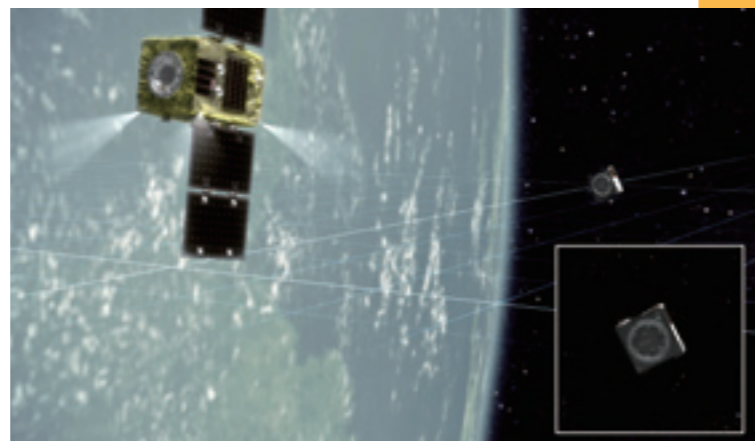
"This garbage patch has grown since the advent of the space age over 50 years ago, with spacecraft parts and artificial satellites," says Ito Miki, General Manager and Managing Director at Astroscale Japan. "It is said that there are more than 36,000 pieces of debris larger than 10 centimeters, and when traveling at high speeds they pack tremendous energy. This poses a threat to the invisible infrastructure in space we depend upon, such as GPS satellites."

In 2013, entrepreneur Okada Nobu attended the European Conference on Space Debris. He heard lots of talk about the growing space debris problem but no real solutions. Ten days later, he founded Astroscale in Singapore, the first private company aiming to tackle the very complex task of capturing and safely removing high-energy debris in orbit.

Since then, the new business venture has raised some 33 billion yen (\$300 million, as of 2021) in funding, formed partnerships with entities including the Japan Aerospace Exploration Agency (JAXA) in 2017 and the European Space Agency (ESA) one year later. The startup has established overseas operations in Japan, the United Kingdom, and the United States. In 2019, it reorganized itself as Astroscale Holdings Inc.

ambition to clean up space, which met with skepticism everywhere at first, has now become well received here." This point was further affirmed when the company was selected in 2020 as an Innovation Tokyo Project of the Tokyo Metropolitan Government, to receive support for technological development through grants of up to 500 million yen.

A number of specific services are now in the pipeline. End-of-Life (EOL) services involve the retrieval and safe disposal of satellites that have ended their



The "servicer" spacecraft maneuvers to retrieve the CubeSat in the simulated ELSA-d technology demonstration mission.



Astroscale Japan General Manager and Managing Director Ito Miki explains the ELSA-d technology.

useful lives, preventing the increase of space debris. In March 2021, Astroscale launched the ELSA-d debris removal technology demonstration mission, which consisted of a 175-kilogram "servicer" spacecraft paired with a 17-kilogram "client" CubeSat acting as simulated debris. In a simulation of satellite retrieval, the two spacecraft were separated from one another and then the CubeSat was recaptured. It was the first such demonstration successfully proving the feasibility of many core technologies and operational functions required for debris removal, including guidance approach from long distances, carried out by a private space startup.

Other services under development by the startup include cleaning up existing larger debris such as used upper stages from launch vehicles, providing motion analysis of objects in orbit, and extending life of operating geostationary satellites. Research by Northern

Sky Research forecasts \$14.3 billion in such In-Orbit Servicing and Manufacturing (IoSM) revenue, driven by Life Extension, possibly generating \$4.7 billion through 2031. But more importantly, realization of these projects will lead to an awareness of the need, and the eventual achievement, of protection of the orbital environment around Earth.

Ito likens the current state of space development to the early days of motor vehicles, before the advent of comprehensive traffic regulations, when accidents were common.

"By the year 2030, the target year for achieving the UN Sustainable Development Goals (SDGs), we would like to have on-orbit services, like a space version of roadside service, as a fundamental part of space development," says Ito. "In that way, we can help make space development sustainable for the use of future generations."