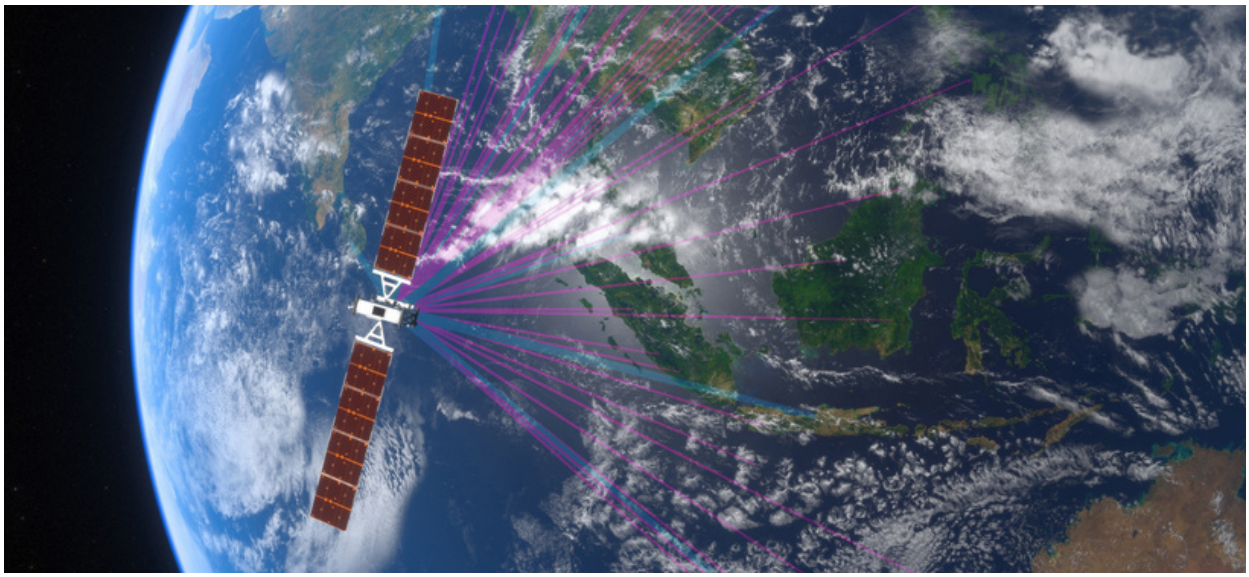
OPINION ● ACADEMIA

Rethinking Indonesia’s future at low earth orbit



Terabit-level capacity and fibre-equivalent latency on upcoming satellite networks make them well-suited to digitally connect vast, archipelagic countries like Indonesia

Yaries Mahardika Putro and Ridha Aditya Nugraha (The Jakarta Post)
Surabaya/Jakarta ● Thu, September 29, 2022

Outer space activities that were originally carried out during the Cold War era for ideological purposes have now turned into a competition for commercial benefits. The private sector is a new player in international space activities with significant roles. Amazon Kuiper, OneWeb and Starlink are among the private parties actively involved in commercial space activities.

In the early days of the development of outer space activities, the primary objective of satellite launches was to place satellites in geostationary orbits. In addition to low earth orbit (LEO), medium earth orbit and highly elliptical orbit, the geostationary orbit (GSO) is one of four orbits that serve as satellite operating trajectories. The commercial value of the communications satellite industry, which generally orbits the GSO, has diminished.

Private parties are now dominating space activities, with most wishing to launch their satellites into the LEO, where most satellites operate because their faster clock speed makes them more useful than GSO satellites. Initially, only large-scale satellites were launched to the GSO. However, the launch of small-scale satellites or small satellites to the LEO has become a new attraction in the space industry. Small satellites launched into the LEO are typically employed for communications.

Private parties are now dominating space activities, with most wishing to launch their satellites into the LEO, where most satellites operate because their faster clock speed makes them more useful than GSO satellites.

Initially, only large-scale satellites were launched to the GSO. However, the launch of small-scale satellites or small satellites to the LEO has become a new attraction in the space industry. Small satellites launched into the LEO are typically employed for communications.

Small satellites offer the advantage of lower production costs than large-scale satellites, which are so expensive that they cannot be produced in large quantities. As a comparison, the cost of producing a small satellite is approximately US$1 million, against $400 million for a large satellite. The weight of small satellites ranges from less than 1 kilogram for pico-satellites to 1,000 kg for mini-satellites.

With the low cost of producing these small satellites, satellite companies such as Amazon Kuiper, Oneweb and Starlink are encouraged to form a satellite constellation at the LEO. A large number of satellites are required.

According to the United States Federal Communication Commission (US FCC), Starlink was granted permission in 2018 to launch 4,409 satellites into the LEO for its initial phase. Starlink has launched 2,042 satellites into the LEO as of January 2022, and the company plans to launch a total of 42,000 satellites in the long term.

Oneweb plans to launch 2,000 small satellites at the LEO while Amazon will launch 3,000 satellites. With the large number of satellites launched to the LEO, which has an altitude from 160 to 2,000 kilometers above sea level, communication delays on Earth shall be reduced.

LEO satellite constellation is also being utilized to operate full Marine Autonomous Surface Ship (MASS) technology. This shipping technology utilizes the LEO satellites’ low latency and minimum delay signal for MASS. With the operation of the MASS, which is controlled by artificial intelligence that receives signals from the LEO satellites, the number of lives lost among sailing crews are reduced, thereby increasing safety.

Iridium and Rolls-Royce Marine have signed a letter of intent to collaborate on the MASS development project. Subsequently, the LEO satellites have recently been used for 5G smart mining technology, in place of the old system that required humans for mining exploration and extraction processes conducted below the Earth's surface.
Nonetheless, it is now fully autonomous, much like the MASS operating technology. This technology will ensure miners’ safety working beneath the surface. Despite such advantages, LEO utilization faces challenges. A legal vacuum, the Kessler syndrome – a scenario where there is too much debris orbiting space – and the disruption of astronomers' space observation

Nonetheless, it is now fully autonomous, much like the MASS operating technology. This technology will ensure miners’ safety working beneath the surface.

Despite such advantages, LEO utilization faces challenges. A legal vacuum, the Kessler syndrome – a scenario where there is too much debris orbiting space – and the disruption of astronomers' space observation processes are impediments posed by LEO satellite technology.

There is currently no international legally binding instrument governing the regulation of orbital slots for LEO satellite launches. The legal framework of the International Telecommunication Union (ITU) regulates only the arrangement of orbital slots and frequencies for large-scale satellites in the GSO.

National regulatory agencies, such as the US FCC, have governed the orbital slots and frequencies in the LEO. The increase in LEO filings with national regulatory agencies raises grave concerns regarding the long-term safety and sustainability of space, particularly in regard to space debris issues.

As more satellites are launched into the LEO without a comprehensive range of orbital slots, the likelihood of satellite collisions increases. This phenomenon is known as Kessler syndrome. This situation will contribute to the growing amount of space debris in outer space as the likelihood of space collisions increases.

This will also pose a threat to the International Space Station (ISS) which operates in the LEO. The satellite mega-constellations in the LEO also affect astronomers' ability to conduct space observations as the reflection of light emitted by the LEO satellite mega-constellation interferes significantly. Obviously, this will hinder astronomers' ability to observe and investigate natural space objects.

Currently, Indonesia is building the largest observatory in Southeast Asia, in Timau, East Nusa Tenggara. The archipelago has a vested interest in preserving its "dark skies" despite the effects of the satellite mega-constellations in the LEO. Over the past two years, the Indonesian government has investigated the landing rights of several LEO satellite service providers, including Starlink and Oneweb.

Telkomsat, a state-owned satellite company, acquired Starlink's landing rights in June. Currently, the government is studying the proposal to also grant Oneweb landing rights. The use of the LEO satellite constellation will promote the even distribution of internet access and reduce the digital

services gap in the country.

No rules in the LEO could be interpreted as space-faring countries' open race to occupy the orbit. It is an opportunity and at the same time a threat pertaining to LEO sustainability. The next generation's interests should be preserved.

Indonesia, classified among non-tier 1 space-faring countries, stands a great chance to promote pro-LEO sustainability national legal framework. Provisions on satellite material to ensure zero space debris is plausible. Such provision shall bind those who launch from the future Biak Spaceport in Papua, which offers lower costs due to its strategic location near the equator.

An opportunity has arisen for Indonesia to lead such an initiative.

***

Yaries Mahardika Putro, lecturer of Air and Space Law at the Law School, University of Surabaya. Ridha Aditya Nugraha, Air and Space Law Studies, Prasetiya Mulya University.