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New Year Messages

From the Minister for Internal Affairs and Communications, Secretary-General of ITU, President of ITU-AJ

Special Feature

Efforts toward Non-Terrestrial Communications

NTT DOCOMO's Efforts toward NTN

SoftBank's Ubiquitous Transformation

Non-Terrestrial Network (NTN) Trends and SKY Perfect JSAT Initiatives

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About ITU-AJ

The ITU Association of Japan (ITU-AJ) was founded on September 1, 1971, to coordinate Japanese activities in the telecommunication and broadcasting sectors with international activities. Today, the principle activities of the ITU-AJ are to cooperate in various activities of international organizations such as the ITU and to disseminate information about them. The Association also aims to help developing countries by supporting technical assistance, as well as by taking part in general international cooperation, mainly through the Asia-Pacific Telecommunity (APT), so as to contribute to the advance of the telecommunications and broadcasting throughout the world.

2026 MIC Minister's New Year's Greeting

HAYASHI Yoshimasa
Minister of Internal Affairs and Communications

I would like to extend my warmest New Year's greetings to all. To introduce myself, my name is HAYASHI Yoshimasa, and I was appointed Minister of Internal Affairs and Communications in October 2025.

First, allow me to offer my heartfelt condolences to those who lost their lives in the recent disasters, including the heavy rains in August 2025, Typhoons No. 22 and No. 23, and the tsunami caused by the earthquake off the Kamchatka Peninsula. I also wish to express my sincere sympathies to everyone affected.

Japan is facing a variety of social issues such as a shrinking population and a declining birthrate and aging population. As Minister of Internal Affairs and Communications responsible for a wide range of administrative areas widely and closely related to the lives of all citizens, I will address those issues with all my strength under the Cabinet of Japan's basic policy of "building a robust economy, turning people's unease and apprehension over their current lives and the future into hope."

Ensuring a Reliable and Trusted Information and Communications Environment

On the Internet, the spread of false or misleading information and rights infringements such as defamation have become increasingly serious, particularly during disasters or elections.

Through the steady implementation of the Japan Information Distribution Platform Act (IDPA) enacted in April 2025, we will promote faster removal of such content by service providers and greater transparency in their operational practices.

We are promoting comprehensive measures in this area including initiatives to improve digital literacy across a wide range of generations and the research and development of technologies to counter disinformation and misinformation, all in collaboration with related operators and organizations.

Cyber-security measures are vitally important, and in addition to promoting R&D and the training of human resources in this area, we aim to enhance data analysis techniques to deal with cyber attacks and other threats.

We will also take a variety of measures to prevent improper use of telecommunication services to run frauds and scams that are becoming increasingly complex and sophisticated, including enhanced countermeasures to phishing emails.

Additionally, from the viewpoint of making broadcasting sustainable given its social role of fulfilling the public's right to know, we are promoting further studies on the future image of broadcasting and the way in which broadcasting systems should operate.

Strengthening International Competitiveness and Ensuring Economic Security

Based on the "DX and Innovation Acceleration Plan for 2030" released in May 2025, we will promote the technical development and building of a new digital infrastructure supporting the AI society and actively pursue its overseas deployment.

Specifically, in collaboration with the National Institute of Information and Communications Technology (NICT), the nexus between industry, academia, and government, we will promote the research and development and international standardization of the All-Photonics Network as the core of the next-generation information and communication infrastructure. We will expand these efforts to the space and quantum fields as well and aim for the early social implementation and overseas deployment of related technologies.

To this end, we will work closely with international institutions such as the Universal Postal Union (UPU), International Telecommunication Union (ITU), and Asia-Pacific Telecommunity (APT), which include many senior officials from Japan.

We will also promote the regional dispersion of data centers based on advanced Watt-Bit Collaboration between the communication and power infrastructures and push forward the building and defense of a digital infrastructure supporting the AI society including submarine cables, 5G, and optical fiber.

To ensure the autonomy of Low Earth Orbit (LEO) communication satellite constellations that are effective in times of emergency, we will promote infrastructure development through public and private investment.

We will promote the overseas development of digital infrastructures such as 5G and submarine cables vital to ensuring economic security through a sustainable and stable supply of risk money from the Fund Corporation for the Overseas Development of Japan's ICT and Postal Services (Japan ICT Fund) under international cooperation.

As for AI, a "Reporting Framework" has been implemented in relation to the "Hiroshima AI Process" in which Japan leads the way in formulating international rules. Based on this framework, we will work to expand the number of supporting countries and support initiatives by companies and other entities adhering to the rules of conduct.

Together with the above, we will widely disseminate and raise awareness of "AI Guidelines for Business" that sets guiding principles for the development, provision, and use of AI.

Additionally, to bolster the abilities of domestic enterprises to develop trustworthy AI, we will strongly support the maintenance and expansion of high-quality Japanese-language data for AI training held by NICT, its provision to domestic operators, and the research and development of AI evaluation platforms.

Next, we will provide production support, the training of human resources, and the overseas dispatching of personnel to promote the international expansion of Japanese broadcast content, and we will strongly work to establish a production and distribution environment to promote proper transactions and fair compensation.

Moreover, given that "information and communications" has been included as one of the strategic fields requiring comprehensive support at the newly established "Headquarters for Japan's Growth Strategy" established in November 2025, we will promote investments in the field of information and communications through public and private partnerships.

In Closing

Let me conclude by wishing everyone good health and prosperity in the year ahead.

New Year Message for *New Breeze* magazine, ITU Association of Japan

Doreen Bogdan-Martin
Secretary-General
International Telecommunication Union

As the first sunrise of 2026 shines over Japan and the world, we are filled with a renewed sense of purpose and hope. Without diminishing the magnitude of our many global challenges, I begin this year with gratitude for all we've achieved together in 2025 and confidence in what we can accomplish in the year ahead.

Last year was one of significant momentum, but also a milestone moment for ITU and the global digital community. Together, we marked ITU's 160th anniversary on May 17, a chance to reflect on how far we've come — from the age of telegraphy to the era of AI and the dawn of quantum computing. Yet, it also reminded us how much further we must go to ensure that digital technologies not only connect people everywhere but help us tackle the challenges of our time while advancing progress on the Sustainable Development Goals.

Japan has been part of that story almost from the beginning. When Japan joined ITU in 1879, it reflected truly international technical cooperation. For nearly a century and a half, Japan has remained one of ITU's most dedicated members, combining innovation, excellence, and a spirit of multilateralism that continues to inspire our work today. It is also one of our biggest budget contributors, enabling ITU to help developing countries strengthen their technical and regulatory capacity.

In Geneva, we celebrated our 160 years with events reflecting the past and future of technology, including a lightshow at ITU headquarters symbolizing how innovation can light a path toward progress. We were equally proud to mark this anniversary at the United Nations Pavilion of EXPO 2025 Osaka; a showcase of technology highlighting how digital cooperation can help shape a more inclusive and connected future.

Throughout 2025, Japan remained one of ITU's most active Member States across all three sectors. From pioneering 5G and contributing to early 6G development, disaster-resilient infrastructure, affordable access and green digital transformation, Japanese experts continue to shape global standards and strengthen our capacity to use technology for good.

At ITU, we were especially proud to see our Director of Telecommunication Standardization, Seizo Onoe-san, receive the prestigious Institute of Electrical and Electronics Engineers (IEEE) Jagadish Chandra Bose Medal in Wireless Communications — the first ever awarded. His achievement, for contributions to the development, collaborative facilitation, and deployment of 3G and 4G mobile communication systems through R&D and global standardization — reflects the best of Japan's innovation and its global impact through ITU's work.

2025 also reaffirmed the importance of working together. At the 80th session of the UN General Assembly in New York, two-thirds of world leaders raised digital issues in their statements, with AI at the top of the global agenda. We also saw the launch of the Global Dialogue on AI Governance — an inclusive forum where governments, industry, academia, and civil society can co-design frameworks for safe, ethical, and human-centred AI.

As the UN specialized agency for digital technologies, ITU looks forward to supporting the UN Secretary General in hosting the inaugural Global Dialogue along the margins of our flagship AI for Good Global Summit in Geneva next year.

Last summer's concurrent AI for Good and WSIS+20 High-Level Event in Geneva drew more than 11,000 participants from 169 countries — the largest and most diverse in each event's history. We saw inspiring advances in brain-machine interfaces, quantum technologies, AI for health, and digital solutions for climate action. Japan's participation in AI conversations reminds us that when people come together, dialogue can lead to inclusive cooperation, concrete action, and hope.

Japanese companies, universities and experts continue to bring deep technical insight and ethical leadership to our global AI community. Japan's support for AI and cybersecurity capacity-building programmes, and its pledges under the Partner2Connect Digital Coalition — which reached $80 billion (USD) in commitments at our Digital@UNGA Anchor Event in New York — demonstrate Japan's commitment to closing the digital divide and keeping people safe online.

Looking ahead, ITU and Japan are working closely on shared priorities that will shape the digital decade ahead: implementing the guidance offered by the WSIS framework, including its 20-year review, and the Global Digital Compact; aligning digital cooperation with sustainable development and human rights; advancing the Green Digital Action initiative, and expanding connectivity and digital skills in developing countries and in small island and landlocked states.

Japan's leadership, through more than 50 members from industry, universities, research institutes, associations and other organizations, remains essential to these efforts. Your technical excellence, generosity, and steadfast belief in international cooperation continue to make a real difference.

The world today faces profound challenges, from conflict and economic uncertainty to the accelerating climate crisis. Yet it also holds opportunities for connection, innovation, and collective action. Let us draw strength from our shared history and from the enduring partnership between ITU and Japan to guide the digital transformation of tomorrow.

From all of us at ITU, I extend heartfelt thanks to the ITU Association of Japan for your invaluable support.

May 2026 bring renewed collaboration, innovation, and peace for all.

Akemashite omedetō gozaimasu.

New Year's Message

Hiroshi Yoshida
President
The ITU Association of Japan

Wishing everyone a Happy New Year!

In 2025, Expo 2025 Osaka, Kansai, Japan was held from April 13 to October 13 welcoming more than 29 million people before coming to a successful close. We respect the efforts of the sponsoring companies that helped make the Expo a success. The International Telecommunication Union (ITU) also held a special exhibition marking its 160th anniversary from May 13 to 18 during the Expo. Looking around the world, the order following the Second World War is now being challenged as we enter a period of great upheaval. Although there are movements toward peace in relation to the conflict in the Middle East and Russia's invasion of Ukraine, the situation is still unpredictable. In Japan as well, we must navigate the difficult course of diplomacy and defense. The importance of economic security is being discussed and the strategic use of international standards is becoming increasingly important.

Looking back at our ITU-related meetings in 2025, the 49th meeting of ITU-R Working Party 5D was held from June 24 to July 3 at Kobe Fashion Mart on Kobe Rokko Island. Featuring 338 participants attending in person from 59 national regulatory authorities and 81 sector members (606 meeting registrants in total), discussions were held on a variety of topics toward IMT2030. The ITU-AJ served as secretariat of this meeting supporting reception activities and excursions to the Osaka Expo.

In relation to ICT, ITU-AJ served as secretariat managing the Japan Pavilion at the Mobile World Congress held in Barcelona, Spain from March 3 to 6, 2025 (MWC-25). Here, we supported exhibits from Japanese companies planning to expand overseas with a focus on small- and medium-sized enterprises and start-ups. The exhibitors of the Japan Pavilion promoted technologies to overseas companies, engaged in business negotiations, etc.

Additionally, at the Universal Postal Congress (UPC) of the Universal Postal Union (UPU) held in Dubai, United Arab Emirates in September, we provided on-site secretariat support for the Japanese delegation. At this meeting, Japan's Masahiko Metoki was reelected as Director General of the UPU and Japan was elected as a member country of the Council of Administration and Postal Operations Council.

As for events within the ITU-AJ, we held our "World Telecommunication and Information Society Day" ceremony at the Keio Plaza Hotel on May 16. At the ceremony, the Minister of Internal Affairs and Communications Award was presented to Hitoshi Yoshino (Softbank), who served as chairman of ITU-R SG5 WP5A for 23 years from 2002 and contributed to standardization efforts at ITU-R and elsewhere. A Special Achievement Award was also given to Yuko Harayama (Secretary General of NICT GPAI Tokyo Expert Support Center) for her efforts in leading discussions on AI at academic societies and fostering exchanges and cooperation among industry, academia, and government at discussion forums. She also gave the Anniversary Lecture at this ceremony. In addition, 12 persons received Accomplishment Awards and 14 persons and one team received Encouragement Awards. Congratulations to all award winners!

Furthermore, as the secretariat for Asia-Pacific Telecommunity (APT) training on network planning to eliminate the digital divide, we received ten trainees from nine countries from December 2 to 9 in Shinjuku, Tokyo.

As for ITU-related meetings in 2026, the APT Conference Preparatory Group for the World Radiocommunication Conference (APG 27-3) will be held in Sapporo in July, and the ITU Plenipotentiary Conference (PP-26) will be held in Doha, Qatar in November. Based on our experience to date, the ITU-AJ aims to participate actively in ITU and APT meetings and events in collaboration with concerned parties.

This year too, the ITU-AJ will continue to publish the online monthly "ITU Journal" and the English quarterly "New Breeze," hold research seminars with experts as invited speakers, and hold liaison meetings to share information on ITU gatherings with a cross-section of people involved in ITU work. The ITU Association of Japan is committed to becoming a nexus for collaboration and exchanges among the Japanese government, our supporting members, and ITU/APT.

As our New Year's greetings, we sincerely pray for your good health and success in the coming year.

WP5D meeting

MWC-25 Japan Pavilion

NTT DOCOMO's Efforts toward NTN

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NTN Design Office
NTT DOCOMO, INC.

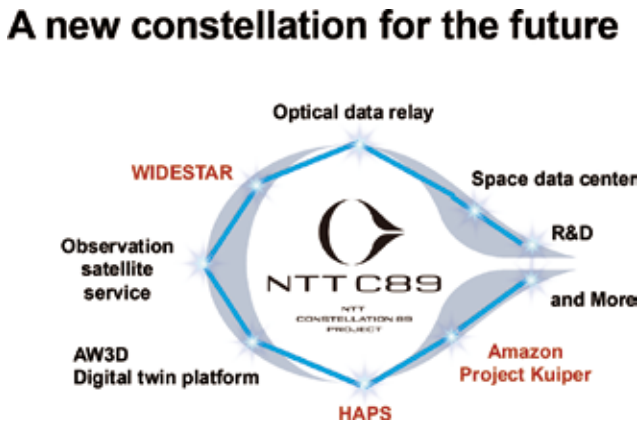
1. Introduction

The market scale of Japan's space business is 4 trillion yen as of 2020 with expectations of reaching 8 trillion yen in the early 2030s*1. This is a high-growth market, and the Japanese government has formulated a "Basic Plan on Space Policy" toward the development of space business with the aim of solving a variety of problems on Earth and achieving more prosperous economic and social activities. Of particular interest here is the space solutions industry, and fields like satellite data usage and communications are expected to be drivers of this growth.

The NTT Group launched "NTT C89" in 2024 as a unified brand in the space business field under the theme of "a new constellation for the future." In this regard, there are 88 constellations in the world that will guide us toward the future as they have guided us in the past. The current space businesses of the NTT Group are like small stars that will come together in an organic manner to become a large business. In other words, we seek to create a new 89th constellation from our current business endeavors and contribute to the future of Japan's space industry (Figure 1).

This article introduces those efforts within NTT C89 centered about the NTT DOCOMO Group such as WIDESTAR, HAPS, and Project Kuiper*2 and the "multi-layer network concept" promoted by the NTT DOCOMO Group.

Figure 1: C89



2. NTN Strategy of NTT DOCOMO Group

At present, the Terrestrial Network (TN) in Japan achieves an extremely high population coverage of more than 99.9%. However, there are still "out of range" areas such as some mountainous areas and remote islands that communication services cannot reach so that area coverage is only at about 60%. With this in mind, a Non-Terrestrial Network (NTN) has been gathering attention as a means of covering a wide area from the sky and providing communication services to locations that TN cannot reach.

NTT DOCOMO has been involved in the NTN area for some time. It launched the WIDESTAR satellite telephone service in 1996 and is currently providing WIDESTAR III as the 3rd generation of this service. In recent years, however, the environment surrounding this area has been undergoing rapid changes, and NTT DOCOMO as well has been particularly active. For example, NTT DOCOMO began in 2023 the provision of "Starlink Business," a satellite broadband Internet service developed by SpaceX, announced a strategic collaboration with Amazon.com, Inc. ("Amazon") in Project Kuiper in the same year, and concluded in 2024 an asset and business partnership with AALTO HAPS Limited ("AALTO"), a subsidiary of Airbus Defence and Space ("Airbus"), toward High-Altitude Platform Station (HAPS) development.

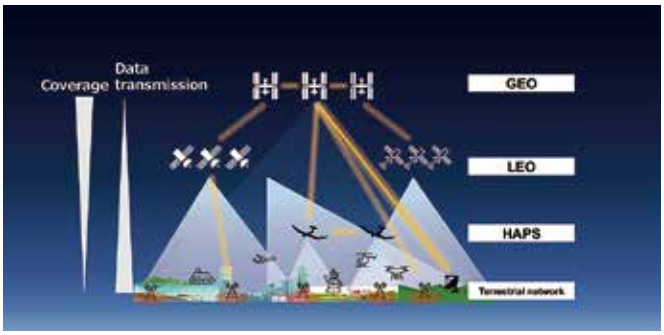
The NTT DOCOMO Group is promoting its original "multi-layer network concept" that aims to integrate Geostationary Earth Orbit (GEO) satellite service, Low Earth Orbit (LEO) satellite service, HAPS, and TN (Figure 2).

The range of coverage, communication characteristics, etc. of GEO/LEO/HAPS differ greatly depending on the altitude, orbit, etc. of each. The idea here is not to make any one of these superior and most powerful but rather to configure an optimal network by combining these systems together with TN. This is a concept that aims to provide high-level seamless and advanced services in the future by linking communications among TN and each of these NTN systems (GEO/LEO/HAPS).

The multi-layer network concept aims for a world in which NTT DOCOMO can "bridge" everyone whenever and wherever, and from that, a world filled with "Wonder" and "Happiness".

*1 From Cabinet Office "Basic Plan on Space Policy" (Approved by the Cabinet on June 13, 2023)
*2 Project Kuiper has changed its name to Amazon Leo.

Figure 2: Multi-layer network concept



3. WIDESTAR (GEO)

NTT DOCOMO launched WIDESTAR III as its 3rd generation mobile satellite communications service in October 2023 (Figure 3). WIDESTAR III covers all of Japan extending to about 200 nautical miles off the coast. This system was the first in the world to provide an LTE over GEO Satellite commercial service through custom development of the Long Term Evolution (LTE) system. It allows for the use of emergency calls (110/119/118) using cell phone numbers.

WIDESTAR III makes effective use of the communication performance of the LTE system, the international standard for cellular systems, and the satellite relay capability of the N-STAR e digital-high-throughput communications satellite equipped with a large deployable antenna. In this way, it has achieved more than six times the number of simultaneous connections (voice call equivalent) of the previous WIDESTAR II system, and as a mobile satellite communications system using frequencies in the 3 GHz band and lower, it has achieved the world's fastest data communication speed in the downlink (maximum 3 Mbps, approximately eight times that of WIDESTAR II). Furthermore, through the development of connection applications with satellite mobile communication terminals ("satellite terminals"), WIDESTAR III has enabled the use of Wi-Fi (Wireless Fidelity)-connected smartphones instead of handsets making communications for users significantly more convenient.

Main features of the WIDESTAR III system are summarized below.

(1) Network reliability

To ensure high reliability as a system, satellite base station equipment and network facilities of the WIDESTAR III system are deployed at two sites with each set of equipment having a redundant configuration of cards, servers, etc. In the event of an emergency such as a natural disaster or base station failure, stable services can still be provided by using the digital processing function of the N-STAR e satellite to change the allocation of frequency resources online.

(2) Load distribution

Load distribution in base station equipment and the core network is essential to stable system operation. To distribute communications load in base station equipment, the system enables a satellite terminal to select the cell of the base station equipment with the lower load at the right time based on information from base station equipment. Additionally, to distribute communications load in core network facilities, the base station equipment directs distributed selection of the core network for satellite terminals accessing the network.

(3) Satellite orbital information

The N-STAR e satellite used by WIDESTAR III is an inclined geostationary orbit satellite having a maximum inclination of ±7 degrees drawing out a "figure 8" in the north-south direction. As a result, fluctuation in satellite propagation delay time normally occurs between base station equipment and satellite terminals. To adjust signal reception timing at the base station equipment from a satellite terminal, satellite control equipment periodically transfers orbital information of the N-STAR e satellite to base station equipment, which notifies satellite terminals of that information through a broadcast signal. Since satellite orbital information includes information covering a certain period of time, service is not affected by a temporary cutoff in the link between base station equipment and satellite control equipment.

Figure 3: WIDESTAR ground station

4. Starlink (LEO)

A LEO satellite orbits the Earth at an altitude around 300 km to 2,000 km, so compared to GEO satellites that orbit at an altitude of about 36,000 km, it is overwhelmingly closer to ground level. Communications services that use LEO satellites therefore feature high speeds, large capacities, and low latency.

In December 2023, NTT DOCOMO began providing "Starlink Business" as a satellite broadband Internet service targeting corporate customers using LEO satellites. In response to the Noto Peninsula Earthquake that occurred in Japan on New Year's Day in 2024, NTT DOCOMO lent out Starlink terminals to stricken local governments and public institutions involved in disaster recovery to support recovery activities. It also provided free Wi-Fi spots using Starlink to give people who had evacuated to shelters a means of communication.

The use of Starlink as cellular backhaul is also progressing, and in the Noto Peninsula Earthquake, the restoration of communications using Starlink achieved results beyond expectations despite the severe damage inflicted on access routes for people and communications. Mobile base station vehicles and ship-mounted base stations used to construct temporary zones in areas losing communications can employ Starlink as backhaul in addition to conventional optical fiber and GEO satellite link. This makes it possible for us to support a variety of environments (Figure 4).

The use of Starlink in normal times is likewise progressing. In this regard, self-driving and autonomous drones are progressing in mountainous areas, the ocean, and other regions in which TN communication is difficult. To give some examples of using Starlink, autonomous weeding and brushing in forestry, real-time video transmission for nighttime search operations, and periodic inspections of the water infrastructure are expected to help reduce workload, improve work accuracy, and reduce costs.

Figure 4: NTT DOCOMO disaster recovery activities using Starlink

5. Project Kuiper (LEO)

In November 2023, NTT DOCOMO together with NTT, NTT DOCOMO Business (NTT Communications at that time), and SKY Perfect JSAT agreed upon a strategic collaboration with Project Kuiper ("Kuiper"), a satellite broadband network provided by Amazon (Figure 5). The reason for this move was to make further and more diversified use of LEO satellite communication services with the aim of providing an advanced satellite broadband network and enhancing the availability and resilience of communications.

The Kuiper system uses a high frequency band called the Ka band that enables high throughput relative to past levels. Additionally, a "private connectivity service" has been announced as part of Kuiper to provide customers with secure satellite communications through direct connections to the user network that bypass the Internet. This will enable users to access their highly confidential servers or proprietary systems in a highly secure manner. Another feature of Kuiper is the ability to access Amazon Web Services (AWS) cloud services and make use of advanced technologies such as AI and machine learning.

As backhaul for base stations, Kuiper has the potential of maintaining communication speed to a certain extent even if traffic should become extremely concentrated such as during a natural disaster.

With Kuiper, NTT DOCOMO aims to make communication services even more robust, provide customers with new options, and contribute to service and value creation.

Figure 5: Project Kuiper

©Amazon.com, Inc.
https://www.aboutamazon.com/what-we-do/devices-services/project-kuiper

6. HAPS

NTT DOCOMO is promoting the commercialization of HAPS communications technology using the stratosphere. HAPS is a system in which unmanned aerial vehicles remain airborne in the stratosphere at an altitude of about 20 km deemed less susceptible to weather effects to provide communications, remote sensing, and other services. Since these vehicles are close to the ground compared to satellites, they can achieve high-speed, high-capacity, and low-latency communications making HAPS applicable to emergency area coverage, early rollout of next-generation communications, etc.

In 2024, NTT DOCOMO and Space Compass formed a capital and business alliance with Airbus and AALTO aiming for commercialization of HAPS in Japan by 2026.

The HAPS "Zephyr" aircraft manufactured and operated by AALTO has a wingspan of 25 m with a weight of only 75 kg.

It features an environment-friendly design driven 100% by solar power. It has been under development for over 20 years, amassed more than 4,000 hours of flight experiments, and set a record in 2025 of 67 consecutive days of flight in the stratosphere (Figure 6).

In terms of communications, a HAPS communications test was conducted in Kenya in January and February of 2025 successfully achieving communications using a special messaging application. Moreover, in a data communications test, a communication speed of 4.46 Mbps was measured.

HAPS and Zephyr provide four main features. The first is "direct and high-speed communications with smartphones." Since the system operates close to the Earth's surface compared to satellites, high-speed and low-latency communications become possible enabling everyday smartphones to be used without modification. The second feature is "service flexibility." Depending on the application, the payload such as communication equipment, cameras, and radar can be easily changed to provide diverse services. The third feature is "high portability." A HAPS system can be rolled out quickly at a location during a natural disaster, a special event, etc. The fourth feature is "environment friendly." The Zephyr aircraft can be operated 100% on solar power enabling sustainable communications with a low environmental load.

Specific application examples include disaster recovery, communications for remote islands, on the sea, and in mountainous areas, and communications with drones flying over a wide area. HAPS can also be used to obtain high-accuracy observation data in real time by mounting an optical camera, and it can be used to manage progress at construction sites, determine conditions during a natural disaster, etc. Going forward, even more applications can be envisioned such as carbon dioxide detection by mounting a hyperspectral camera, mineral exploration, and radio wave monitoring.

7. Conclusion

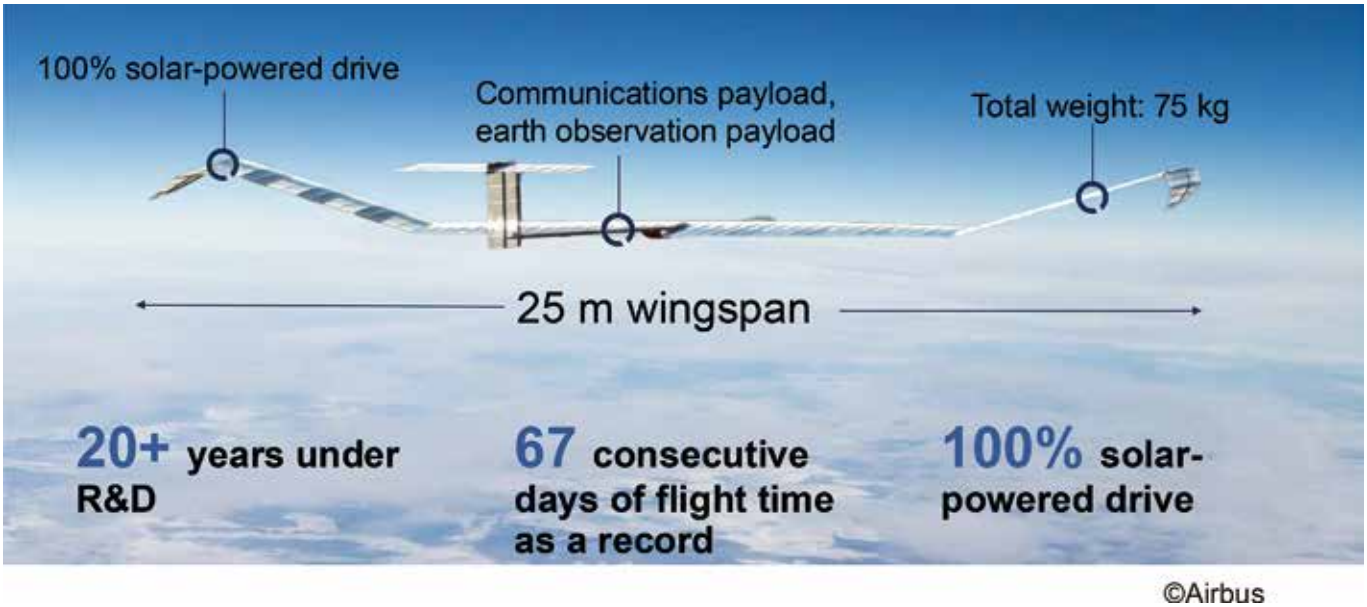
This article described NTT DOCOMO's efforts in each of the GEO/LEO/HAPS systems and its "multi-layer network concept" that aims for an optimal and advanced network by combining and linking these systems together with TN.

At present, GEO/LEO/HAPS are individual systems each having an original interface and other components. In the future, however, integrating communications and operations among these NTN systems and between NTN and TN will make it possible to provide high-level seamless and advanced services. At that time, we can expect inter-system compatibility and usability to improve and the cost of introduction to be reduced by standardizing interface specifications and enhancing interoperability.

Services that provide direct satellite communications via smartphones have recently been launched. Although there have been many services with dedicated terminals, enabling satellite communications via commonly used smartphones achieves a significant jump in convenience. NTT DOCOMO, as well, is preparing to launch a satellite direct communication service with smartphones in 2026.

Through the evolution of NTN, NTT DOCOMO aims to create a more prosperous society by providing best-mix and robust network services to meet the diverse needs of our customers, such as ensuring communications during natural disasters and making communications in business and everyday life more convenient in remote locations.

Figure 6: HAPS "Zephyr"



SoftBank's Ubiquitous Transformation

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1. Introduction

1.1 The next challenge in the Information Revolution

The spread of the Internet and mobile communications has brought dramatic changes to society, industry, and lifestyle. However, large-scale disasters occur almost daily worldwide as a result of climate change, and there are still regions without an adequate social and communication infrastructure, so some people and industries are being left behind unable to reap the benefits of digitalization. Communication gaps caused by situation and location, such as normal times and disaster times, city and village, and land and sea, are inhibiting factors to the creation of new value creating a challenge to the realization of a sustainable society.

1.2 Vision of a Ubiquitous Transformation (UTX)

Under the concept of 'Ubiquitous Transformation (UTX)," SoftBank envisions a world of uninterrupted communications. The aim of UTX is to hierarchically integrate the Non-Terrestrial Network (NTN) that supplements and extends the terrestrial network and to create a society in which "connectivity becomes ubiquitous" regardless of place or time. This initiative will surmount fragmentation at the time of a disaster and infrastructure disparities between regions and dramatically enhance the experiential value of people and things.

1.3 Concept of a ubiquitous network

As a key element in achieving a UTX, a ubiquitous network is a communication infrastructure that seamlessly switches circuits unbeknownst to the terminal side by merging the terrestrial cellular network with multiple networks such as satellite communications and stratospheric communication platforms

Figure 1: Ubiquitous Transformation (UTX) vision

known as High Altitude Platform Station (HAPS). Here, a terminal moving out of range of the cellular network would be automatically handed over to a satellite or HAPS, and then, on returning to ground coverage, would be reconnected to the cellular network. This concept of viewing the sky-based and ground-based networks in three dimensions and transparently configuring multiple layers is exactly the key to achieving communications "anytime, anywhere, for anyone."

1.4 SoftBank NTN portfolio and partner strategy

SoftBank is lining up a variety of NTN solutions as a foundation for achieving a ubiquitous network. In Low Earth Orbit (LEO) satellite networks, broadband connection services such as Starlink Business and Eutelsat OneWeb are being rolled out tailored to specific needs with different characteristics. In addition, HAPS, which provides communication services from unmanned aerial vehicles stationed in the stratosphere, directly accommodates smartphones with each station covering a wide area up to 200 km in diameter. Our plan is to bundle up these multiple NTNs and the terrestrial cellular network as a "multi-orbit + mobile network" and construct a mechanism for autonomously selecting an optimal circuit according to use case.

1.5 Impact on mobility field

SoftBank regards the mobility field as the most important use case of the ubiquitous network. Moving bodies such as self-driving cars, construction machinery, drones, and ships frequently move in and out of cellular range. If connections can be securely maintained at all times, it will be possible to operate services such as remote monitoring, remote control, preventive maintenance, and high-precision navigation in a reliable manner and dramatically improve transport efficiency, safety, etc. A social infrastructure redesigned with a focus on the mobility field under the assumption that "the ability to communicate is the norm" has the potential to transform industrial structures and daily life.

In this field, SoftBank is proactively collaborating with foreign companies. In June 2025, we concluded a strategic partnership with Cubic[3], a global leader in solutions for software-defined vehicles (SDVs), toward the creation of a ubiquitous network. The plan here is to commercialize ubiquitous network solutions for connected cars within a few years by merging NTNs and the terrestrial cellular network.

1.6 Organization of this article

In this article, we begin by explaining the background and objective of UTX as envisioned by SoftBank. We then discuss the respective technologies of HAPS and satellite communications and their linking with the terrestrial network as key elements in realizing this strategy, collaboration with domestic and foreign partners in each of these areas, and scenarios for social implementation of UTX centered about mobility. Finally, we investigate the conformity of UTX with global standardization trends advanced at ITU and consider a vision for the future brought about by UTX. The authors would be pleased if this article helps readers understand the significance of UTX and its social impact.

2. Efforts toward commercial development of HAPS

2.1 HAPS features: Next-generation communication infrastructure supporting the future from the sky

HAPS focused on by SoftBank is a next-generation infrastructure that is sometimes called "base stations flying in the air" or "stratospheric base stations." It is a technology that

Figure 2: Ubiquitous network configuration

provides communication services to a wide area on the ground via unmanned aerial vehicles that operate in the stratosphere at an altitude of about 20 km. With HAPS, one station can cover a wide area on the ground up to 200 km in diameter enabling the construction of a seamless communication environment whether the target area be an urban area, mountainous area, or remote island.

HAPS boasts three main features as follows.

1. Maintains communications during a disaster: HAPS can help secure a lifeline even at the time of an emergency by providing communication services from the stratosphere even if the terrestrial infrastructure has been damaged.
2. Eliminates the digital divide: HAPS can provide stable mobile communications even in regions in which base stations would be difficult to set up and in areas with a low population density.
3. Supports mobile communications in the sky: HAPS can be used to construct a three-dimensional communication infrastructure with a view to linking with next-generation mobility such as flying cars and drones.

HAPS is extremely effective in dealing with disasters. It can be used to rapidly deploy communications from the sky in isolated regions where ground access is difficult and to greatly improve the immediacy of evacuation guidance and rescue operations. In addition, HAPS can use remote sensing functions to make high-definition observations from the stratosphere and grasp in real time disaster conditions, the range of fires or flooding, etc. HAPS is expected to serve as a new information infrastructure that can support decision-making by local governments and disaster-prevention institutions.

2.2 Technology development and demonstration results: SoftBank meets the challenge of pioneering world-first achievements

After being the first in the world to begin studies on providing HAPS services in 2017, SoftBank has taken on technology development in earnest. In September 2020, SoftBank conducted a test flight using the "Sunglider" Heavier than Air (HTA) HAPS equipped with solar panels. Sunglider stayed aloft in the stratosphere for 5 hours and 38 minutes and successfully delivered LTE communications from the stratosphere as a world's first.

Additionally, in September 2023, in cooperation with the government of Rwanda, SoftBank conducted the world's first 5G communications test from the stratosphere using an unmanned aerial vehicle mounting a 5G communications payload. This test pushed the boundaries of communications technology by establishing a 5G connection for approximately 73 minutes from an altitude of 16.9 km and successfully performing a Zoom video hookup with a team in Japan. These achievements were supported by an accumulation of advanced core technologies supporting harsh environments like the stratosphere. A fusion of technologies from many fields is contributing to the realization of HAPS as in the development of high-energy-density batteries that can operate stably even in extremely low temperatures plus high-efficiency solar panels and lightweight communication devices.

Figure 3: Sunglider (HTA-type HAPS)

2.3 Role as a global leader driving the industry

The international use of new frequencies (700–900 MHz band, 1.7 GHz band, 2.5 GHz band) for HAPS mobile-phone base stations was formally agreed upon at World Radiocommunication Conference 2023 (WRC-23) held from November to December 2023.

In this important decision, SoftBank participated actively as Japan's representative in regional WRC conference preparatory meetings and led technical discussions and international coordination. By building trustworthy relationships with those concerned in other countries and engaging in repeated negotiations, discussions fortunately led to a consensus. As a result, countries can now flexibly select frequency bands when introducing HAPS making it possible to support communications with existing smartphones in many countries. Going forward, the use of HAPS is expected to grow even further as a communications infrastructure in undeveloped areas, as a means of securing communications at the time of a disaster, etc.

As a founding member, SoftBank has also been active in the HAPS Alliance consisting of 103 companies as of July 2025. We have been promoting regulatory development and market creation while coordinating with leading companies in the communications, aviation, and IT fields.

We are also putting effort into intellectual property strategies. In relation to communication technologies that place HAPS aloft in the stratosphere to function, in particular, as wireless relay stations or base stations, SoftBank has obtained more than 90 U.S. patents (Patent Classification H04B 7/18504). This group of patents will be the source of SoftBank's international competitiveness in the future as an indispensable infrastructure technology for the commercial deployment of HAPS.

2.4 HAPS deployment in Japan: Service provision in partnership with Sceye

SoftBank has invested in the U.S.-based company Sceye Inc. as a concrete step toward deployment of HAPS in Japan and has concluded an agreement that gives it exclusive rights to deploy HAPS services in Japan using the Sceye system. Sceye's

Lighter than Air (LTA) HAPS is an unmanned aerial vehicle that rises by the buoyant force of lighter-than-air helium. It can remain airborne for long periods of time and can provide stable communication services.

Figure 4: Sceye (LTA-type HAPS)

SoftBank plans to use this LTA-type HAPS system to launch precommercial services in Japan in 2026. In the initial stage, this system will target the recovery of communications at the time of a disaster. It will operate specifically for securing a lifeline and supporting rescue operations during emergencies while limiting the areas and users covered. In this way, immediate communications support for disaster-struck areas will become a reality in Japan, a country that has a frequent occurrence of natural disasters.

Then, from 2027 on, the outlook is for extending the system to regular communication services, and studies are underway to using it as an observation and monitoring infrastructure. SoftBank will continue to develop LTA-type HAPS in parallel with HTA-type HAPS with the aim of achieving a communications infrastructure with a variety of operation formats in mind.

3. Satellite communication solutions and linking with the terrestrial network

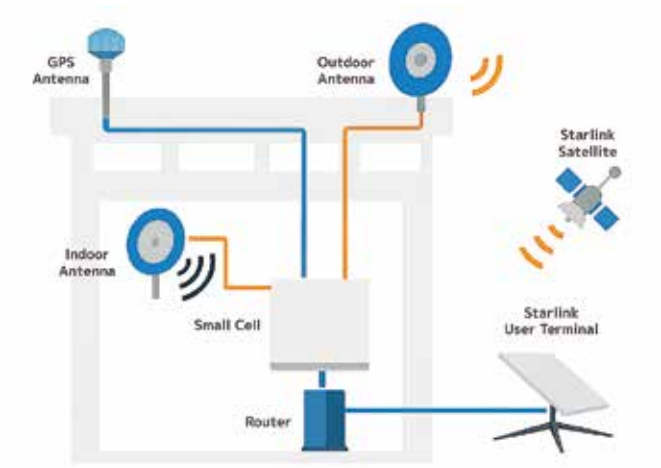
3.1 SoftBank satellite communication solutions and features

SoftBank provides Starlink Business and Eutelsat OneWeb as satellite communication solutions using LEO satellites. Starlink Business features high-speed and low-latency best-effort broadband connections enabling speedy provision of communications over a wide area. Eutelsat OneWeb, on the other hand, supports guaranteed bandwidths and closed network connections making it applicable to business applications requiring secure communications. At present, preparations are being made for the launch of this service in Japan. Flexible network design making best use of the features of both of these services can support a variety of user needs.

SoftBank also provides a corporate service called BizCell that combines Starlink with compact wireless devices. This service enables the use of ordinary mobile phones including emergency calls for SoftBank users and means of communication via Wi-Fi for users of other operators.

In this way, BizCell can be used as an effective communication infrastructure at the time of a disaster or in areas outside the reach of radio waves.

Figure 5: BizCell service using Starlink



3.2 SoftBank internal use

SoftBank proactively uses satellite communications internally. In normal times, geostationary satellites can serve as backhaul circuits for base stations enabling communication areas to be expanded and stable operations to be achieved. At the time of a disaster, they can aid in restoring base stations using portable satellite antennas and in restoring communications quickly by using mobile base stations mounting satellite antennas.

At present, Starlink is also being used in addition to geostationary satellites to secure low-latency and broadband temporary communications. SoftBank is also providing a Wi-Fi service using Starlink at evacuation centers and temporary hubs. This service played an important role during the Noto Peninsula earthquake in January 2024 in helping to confirm the safety of those affected by the disaster and collect information. These operations were constructed based on the lessons learned from the Great East Japan Earthquake of 2011. They aim to secure communications in either normal or emergency situations.

3.3 Satellite communications in an advanced mobility society

Building an infrastructure that enables communications without geographical restrictions is essential to achieving an advanced mobility society of self-driving cars, drones, flying cars, and other mobile bodies. In this regard, one means that is attracting attention is satellite mobile-direct communications. This is a technology that enables ordinary terminals like smartphones to communicate directly with satellites. It features the ability to provide a wide range of communications independent of the existing terrestrial infrastructure. Although SoftBank is not

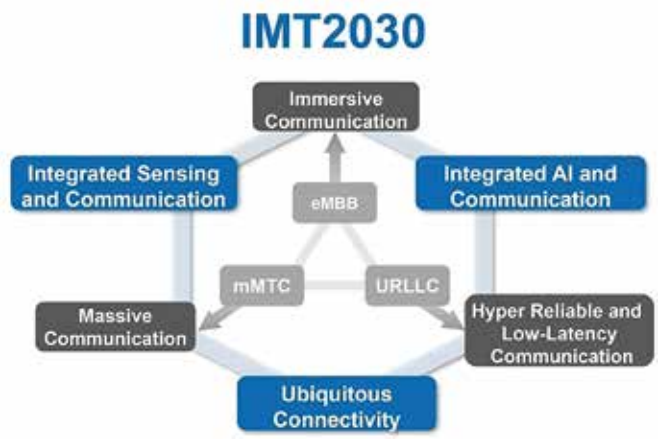
providing this service at present, preparations are being made to launch the service in 2026.

Additionally, with a view to uninterrupted communications in an advanced mobility society, SoftBank and Intelsat began joint technical testing in September 2024 of a hybrid communication solution that will enable automatic switching (roaming) between the terrestrial network and satellite communications (NTN) using 5G standard specifications defined by 3GPP. The ultimate goal here is a mechanism that will allow users to access both networks with a single device and contract while immediately handing over vehicles that move out of range of a terrestrial network to a satellite. The envisioned roadmap calls for the use of existing satellite terminals in the short term followed by the use of a single terminal as the standardization of 3GPP NTN-5G progresses.

3.4 Toward Ubiquitous Connectivity

Ubiquitous Connectivity is positioned as one of the six main scenarios in IMT-2030 defined by ITU-R. This means that in the 6G era, there will be a need for logically merging heterogeneous networks such as terrestrial cellular networks together with Low Earth Orbit (LEO), Medium Earth Orbit (MEO), and High Earth Orbit (HEO) satellites and HAPS so that terminals and applications can be used without having to be aware of the optimal transmission path. Cubic[3], which received investment from SoftBank in March 2024, positions its cloud-native-platform Cubic[3] Cloud at the core of its orchestration operations to provide services that enable the integration of diverse terrestrial cellular networks not limited to those of specific telecommunication operators. SoftBank, through a strategic partnership with Cubic[3], aims to logically integrate the terrestrial cellular network and NTN and achieve Ubiquitous Connectivity by adding NTN communications to Cubic[3] Cloud. In April 2025, in the initial phase of this initiative, SoftBank completed a handoff experiment between the Intelsat satellite communication network and the terrestrial network connected to Cubic[3] Cloud. Through these efforts, the plan is to build an infrastructure that can provide continuous connectivity in the automatic mobility field, which, in the future, will require seamless communications regardless of location for SDVs, transport vehicles, farm machinery, construction machinery, drones, etc.

Figure 6: Relationship between 6G functions and applications



4. Conclusion

This article described SoftBank's vision of a "Ubiquitous Transformation (UTX)" and the technologies and strategies for making UTX a reality. SoftBank aims to integrate the terrestrial cellular network into a multi-layer network including satellite communications and HAPS to create a world that connects "anytime, anywhere, for anyone." Here, HAPS will drive the validation and international standardization of stratosphere communications and serve as a next-generation communication infrastructure from the sky leading to the creation of new services in the mobility field and the restructuring of the social infrastructure. Satellite communications, meanwhile, will facilitate the deployment of communications at the time of a disaster, in out-of-range areas, etc. through flexible designs using services like Starlink and Eutelsat OneWeb. In addition, the development of advanced orchestration technology for mobility applications is now in progress using satellite communications in collaboration with Cubic[3]. These initiatives align with the global vision of Ubiquitous Connectivity at IMT-2030 and are considered by SoftBank to be the key to constructing a communication infrastructure for the next-generation society.

In this way, communications will enter a phase where connections are location-agnostic and instantaneous. SoftBank's UTX lies at the core of this transition, and through UTX, we hope to contribute to society by constructing a sustainable network in which no one is left behind even during disasters and where there is no digital divide caused by being out of range of the terrestrial cellular network.

Non-Terrestrial Network (NTN) Trends and SKY Perfect JSAT Initiatives

—*Toward a World That's Never Out of Range*—

Hiroyuki Yagihashi
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1. Introduction

The words Non-Terrestrial Network (NTN) have been appearing with increasing frequency in recent years especially in online media. The feeling that is often conveyed is that NTN is a new technology and new type of network that can satisfy people's expectations for more progress in their everyday lives.

However, it's hard to form an image from those words alone—what exactly is a "non-terrestrial" network?

■ What is NTN?

In the world of mobile networks, NTN lies in contrast to a network configured with base stations installed on the ground, that is, the Terrestrial Network (TN). The NTN does not use base stations on the ground—rather, it is a network that can be deployed just about anywhere including remote areas, in the sky, on the ocean, and even in outer space. It is expected that Geostationary Earth Orbit (GEO) satellites, Low Earth Orbit (LEO) satellites, and High-Altitude Platform Stations (HAPS) will be used as the infrastructure making up the NTN. In this way, the two-dimensional network used mostly on the Earth's surface and configured with base stations on the ground can be significantly extended into a three-dimensional network (Figure 1).

A major part of the background to NTN studies are NTN infrastructure technologies and contributions made to NTN standardization.

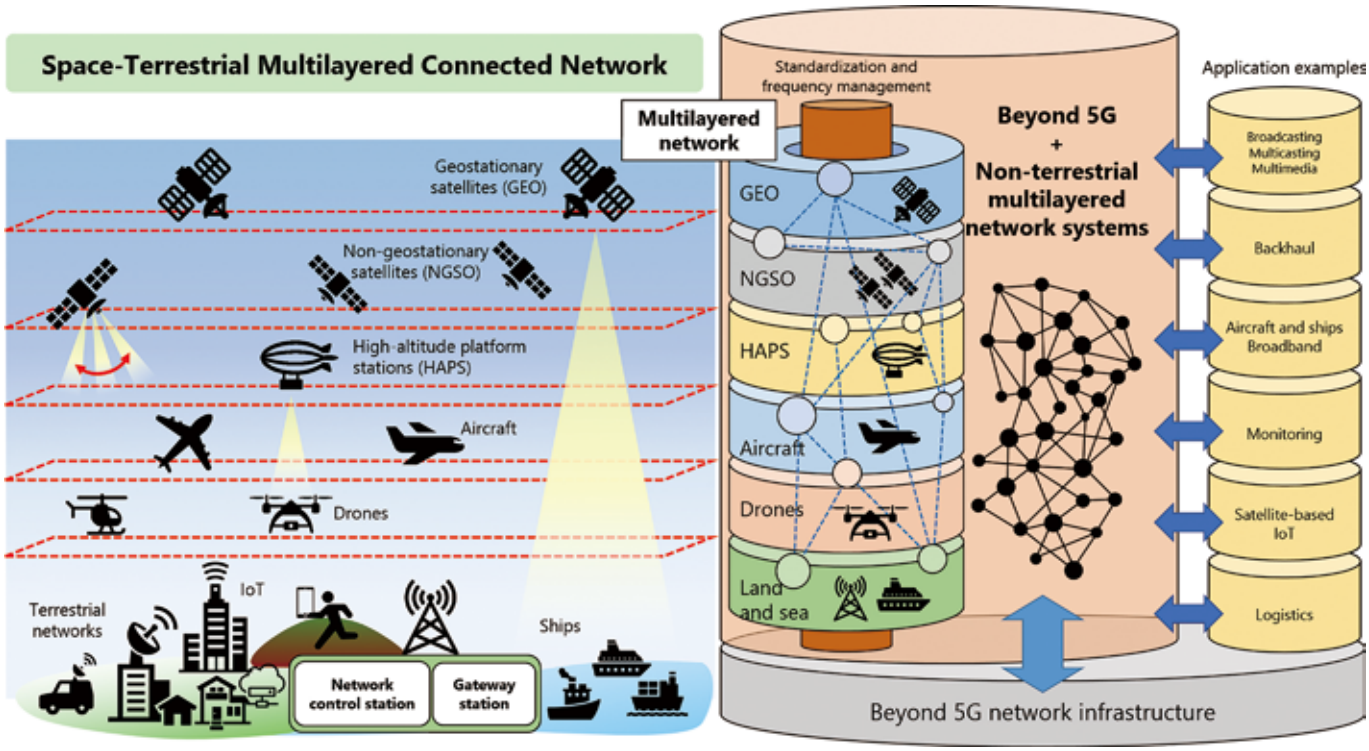
This article introduces recent technological and standardization trends in NTN and NTN initiatives undertaken by various operators.

2. NTN Trends

■ Background to NTN studies

The NTN is a concept proposed at the 3rd Generation Partnership Project (3GPP), a mobile communications standardization organization. Although the norm at one time was to configure networks with mobile phones based on the

■ **Figure 1: Concept of the communication network in Beyond 5G[1]**



proprietary technologies of different companies, this scheme was not necessarily advantageous to end users for many reasons. For example, not only were locally compatible terminals required overseas but compatibility issues arose even within the same country. Against this background, 3GPP was launched to achieve standardization toward third-generation (3G) mobile phones. Through 3GPP, amazing developments have also been achieved in 4G and 5G while striking a balance between cooperation and competition.

Nevertheless, issues are still present. One is coverage. In Japan, although the population coverage of the terrestrial mobile network exceeds 99%, national land (area) coverage is said to be only around 60%. As private companies, mobile operators install base stations with a certain degree of economic rationality, so it is quite difficult to continue to install base stations in 40% of the national land having less than 1% of the population. In this regard, people expect the same access to entertainment in airplanes and on the ocean as on land, and it is assumed that ICT means a continuous connection with the network. As the mobile infrastructure expands and usage grows, coverage issues are conversely becoming more noticeable.

Additionally, as natural disasters become increasingly severe, there is concern that damage to the mobile network caused by destruction of base stations or power outages will have a major impact on people's lives and government/industrial activities. Fortifying the network and formulating methods for speedy recovery have therefore become key issues.

The NTN can be a solution to these issues facing the mobile network, but at the same time, it will never be an infrastructure only for mobile networks. There are high expectations for the creation of totally new use cases such as by linking the mobile network with satellite communications (Figure 2).

■ Smartphone direct satellite communications = NTN?

As described above, NTN was defined by 3GPP, so a network conforming to NTN specifications as prescribed by 3GPP can be called a true "NTN". At present, NTN-supported frequencies are defined as the L-band (1 GHz band), S-band (2 GHz band), Ku-band (12/14 GHz band), and Ka-band (18/28 GHz), and a variety of terminals are envisioned including handsets and Very Small Aperture Terminal (VSAT) ground stations.

At the same time, direct communication between smartphones and satellites has become a hot topic of late, and this capability has also been referred to as NTN. In a broad sense, interpreting this as NTN is not totally incorrect, but there are many cases in which simply connecting smartphones with satellites is mistaken as NTN. This type of direct communication is one form of NTN (strictly speaking, if such a connection does not conform to standards, it may not be compatible with NTN in actual operation), but confusion here should be avoided.

3. NTN Standardization Trends

As described above, NTN-related standardization is proceeding at 3GPP, but coordination with ITUR that's advancing the standardization of wireless interfaces is extremely important. At present, a process is moving forward at ITU-R toward a Recommendation for wireless interfaces that can be applied to 6G, and at 3GPP, studies have begun on standard specifications for radio, core, terminal, and other components to be implemented as 6G.

At 3GPP, studies on enhancing functions and drafting specifications continue as 5G-Advanced also in relation to NTN. SKY Perfect JSAT has been a member of the Association of Radio Industries and Businesses (ARIB) since 2022, and it has been participating in 3GPP particularly in activities seeking to make NTN even more useful from the viewpoint of satellite operators. In Release-19, Ku-band specifications for NTN are progressing, and SKY Perfect JSAT is working together with a variety of overseas and domestic operators and manufacturers on specifications and terminal specifications that can be easily applied to the frequency bandwidths of satellite transponders (repeaters) used by GEO operators, as well as on submitting contributions and proposals on NTN use cases.

Release-19 specifications are expected to be completed by the end of 2025 while supporting products are expected to appear several years later.

4. NTN Initiatives at SKY Perfect JSAT

■ SKY Perfect JSAT's Vision: Universal NTN™

At SKY Perfect JSAT, we are proud to be at the forefront of NTN innovation. Our "Universal NTN™" concept aims to create a seamless, flexible, and intelligent satellite communication network that adapts to diverse user needs—anytime, anywhere [2].

We were among the first in the world to establish a

■ Figure 2: Use case examples of Universal NTN™

dedicated NTN department, driving technology development, standardization, and real-world use cases. By collaborating with global partners and leveraging advanced technologies like Software Defined Satellites (SDS), we are building an ecosystem that supports next-generation connectivity and empowers a super-smart society.

■ Universal NTN strategy

A major goal of Universal NTN™ is to improve the customer experience (CX) and enhance interconnectivity. Providing users with a variety of options is essential to achieving the widespread use of NTN and meeting diverse needs. However, accomplishing that by a single company on its own is difficult, so an ecosystem formed by partnerships and collaborations among companies, research institutions, and other entities having expertise in various fields is expected to ensure diversity. The key to supporting this diversity is interconnectivity through global standards, and the goal is to construct a "horizontally integrated" ecosystem incorporating both business and technical aspects. The NTN, whose standardization is now proceeding at 3GPP, is still under development and the maturation of supporting technologies is expected to take a certain amount of time. Nevertheless, construction of an ecosystem through partnerships is an effective means of supporting the spread of NTN, and it should be a major trend going forward.

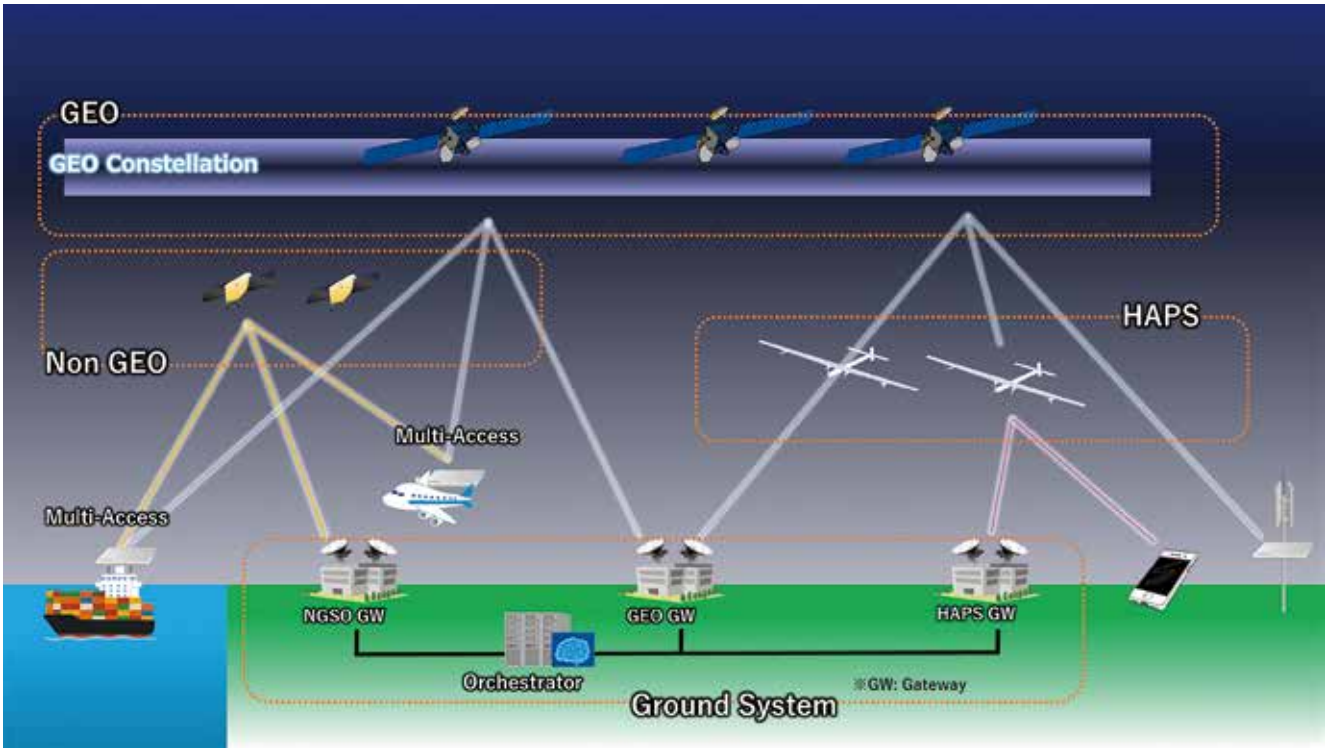
■ Universal NTN™ supporting technologies

An environment that ensures interconnectivity may combine a variety of infrastructures, and Universal NTN™ is a concept that will consist of four layers in the future (Figure 3).

The first is a Geostationary Earth Orbit (GEO) layer. SKY Perfect JSAT has deployed 17 GEO satellites globally (as of June 2025), and by using a certain number of these, a single large-capacity network covering a wide area can be achieved by constructing that network with the same specifications. At SKY Perfect JSAT, such a configuration is called a "GEO constellation." A fully digital Software Defined Satellite (SDS) as described below has an unprecedented level of flexibility and new value for satellite communications. However, at a distance of 36,000 km, a propagation time of approximately 0.25 s is required for a round trip even at the speed of light, so for use cases making use of bidirectional communications, such a delay would really be felt.

The second is a Non-Geostationary Satellite Orbit (NGSO) layer consisting, for example, of Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellites. These satellites that orbit the Earth at altitudes lower than that of GEO achieve global coverage, and since delay time is relatively small compared with GEO, throughput is expected to improve. For use cases like remote operation in which small delay time is desirable, NGSO satellites can manifest their power. On the other hand,

■ **Figure 3: SKY Perfect JSAT multi-orbit concept**



NGSO satellites sink beyond the horizon after being visible from the ground for just a short time, so many satellites must be simultaneously operated to maintain constant communications. As a result, in addition to the massive investment required, complex technical issues must also be addressed such as handovers between satellites and between base stations.

The third is a High-Altitude Platform Station (HAPS) layer. Aircraft on this layer fly in the stratosphere at an altitude of about 20 km, and since they appear to remain within a certain range from the ground similar to GEO satellites, they have also been called High Altitude Pseudo Satellites. Their communication delay is extremely small compared with satellites, and the fact that they can be upgraded and maintained by bringing them down and relaunching is expected to be a major advantage not offered by satellites. On the other hand, achieving both long flights of several weeks and a heavy payload is a technical hurdle, and to cover a wide area, many HAPS aircrafts must be simultaneously operated and kept in the sky, which means that operational issues also exist.

Each of these layers has its advantages and disadvantages as an infrastructure, and to support all kinds of spaces and needs, there are limits to relying on just one. For this reason, a ground system acts as the fourth layer here to interconnect the above three infrastructure layers and appropriately control user-traffic routes, priorities, etc. In this way, the user has no need to be conscious of which infrastructure or frequency is being used. In short, what becomes important for the user is whether one can communicate comfortably with the other party. Here, an intelligent system called an orchestrator establishes the best communications line by selecting an optimal infrastructure according to the Service Level Agreement (SLA) desired by the user and setting parameters to control base stations and terminals to give the best performance possible.

Terminals as well are evolving greatly. In the past, there were few options other than parabolic antennas, but today, many manufacturers around the world are commercializing a type of antenna called a phased array antenna that arranges many antenna elements on a flat substrate and electronically controls those elements to control the direction of radio waves and establish communications. Although phased array antennas are inferior to parabolic antennas in terms of antenna gain and power consumption, they excel in portability and operability thereby giving users a new option to choose from.

New technologies are being actively deployed to meet diverse user needs, and going forward, we can expect the network to evolve in a step-by-step manner.

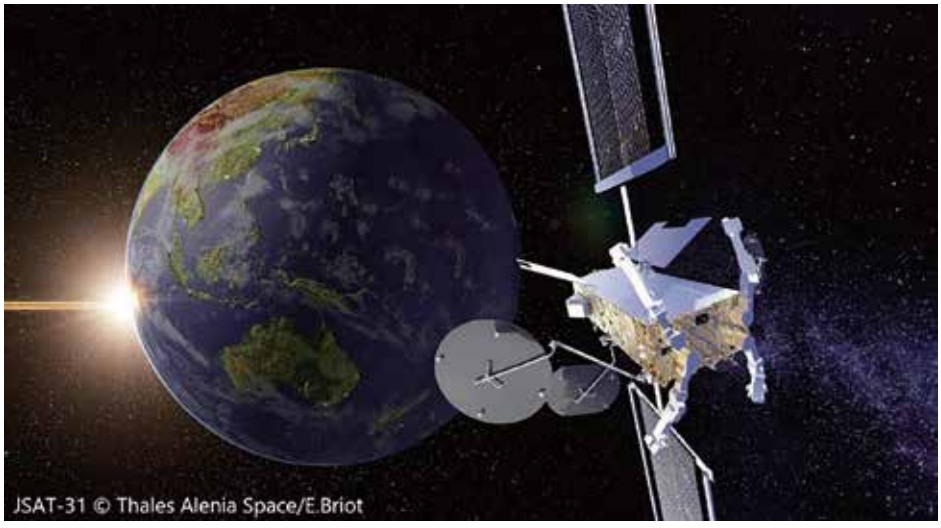
■ Software Defined Satellite (SDS)

Universal NTN™ will also make use of SDS, a powerful tool for next-generation GEO (Figure 4). As the name implies, the functions of a SDS are defined by software in the same manner as a Software Defined Network (SDN) and Software Defined Vehicle (SDV). In the case of conventional satellites, service area is defined at the design stage, so a satellite is configured with hardware such as antennas shaped to irradiate and receive radio waves accordingly plus amplifiers, filters, etc. As a result, the configuration of such a satellite cannot be changed in orbit (although some satellites are equipped with a switch-based function for switching beams).

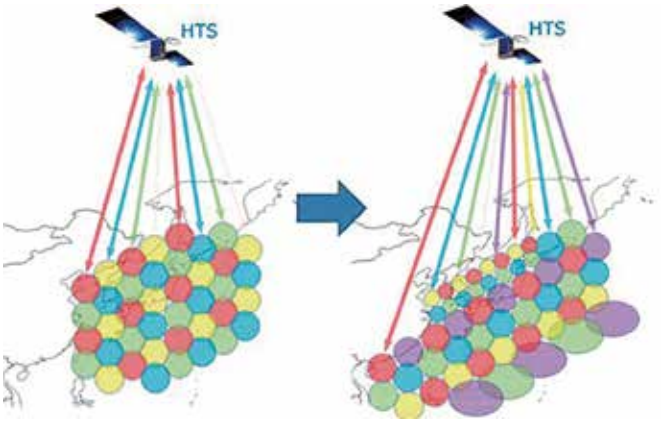
An SDS, however, mounts a powerful processor and performs all basic functions inherent to satellites such as reception, filtering, frequency conversion, amplification, and transmission by digital signal processing.

This makes it possible to change the areas to be irradiated, the frequencies allocated to those areas, and signal intensities

■ Figure 4: Next-generation satellite JSAT-31 (illustration)



■ Figure 5: Changing beam configuration in orbit



all while in orbit enabling flexible support of short-term and long-term traffic needs (Figure 5). For example, if traffic should become locally concentrated due to a large-scale earthquake or other disaster, frequencies and power could be intensively allocated to that area so that a large volume of traffic could be processed. Similarly, SDS could be applied to emerging countries where new demand may arise due to changes in the population, economy, etc.

■ Universal NTN™ Innovation Lab

Universal NTN™ will introduce many new technologies, so as a system consisting of wireless and satellite communication facilities, it is essential that thorough technical testing be conducted with technical partners. Additionally, since this is a new system unknown to business partners and users, it will be necessary to check its effectiveness and test use cases through demonstrations.

With the aim of studying Universal NTN™ from both technical and business viewpoints, SKY Perfect JSAT established the "Universal NTN™ Innovation Lab" ("NTN Lab") within its Yokohama Satellite Control Center (YSCC) in 2024 (Figure 6).

■ Figure 6: SKY Perfect JSAT Yokohama Satellite Control Center (YSCC)

Although the word "lab" is part of the name of this facility, it functions not as a research institution but rather as a "site" for technical and business development with various partners. NTN Lab is furnished with emulators of base stations and terminals conforming to 5G NTN (NTN standardized on 5G) that can connect with actual satellite circuits to test characteristics, performance, etc. (Figure 7).

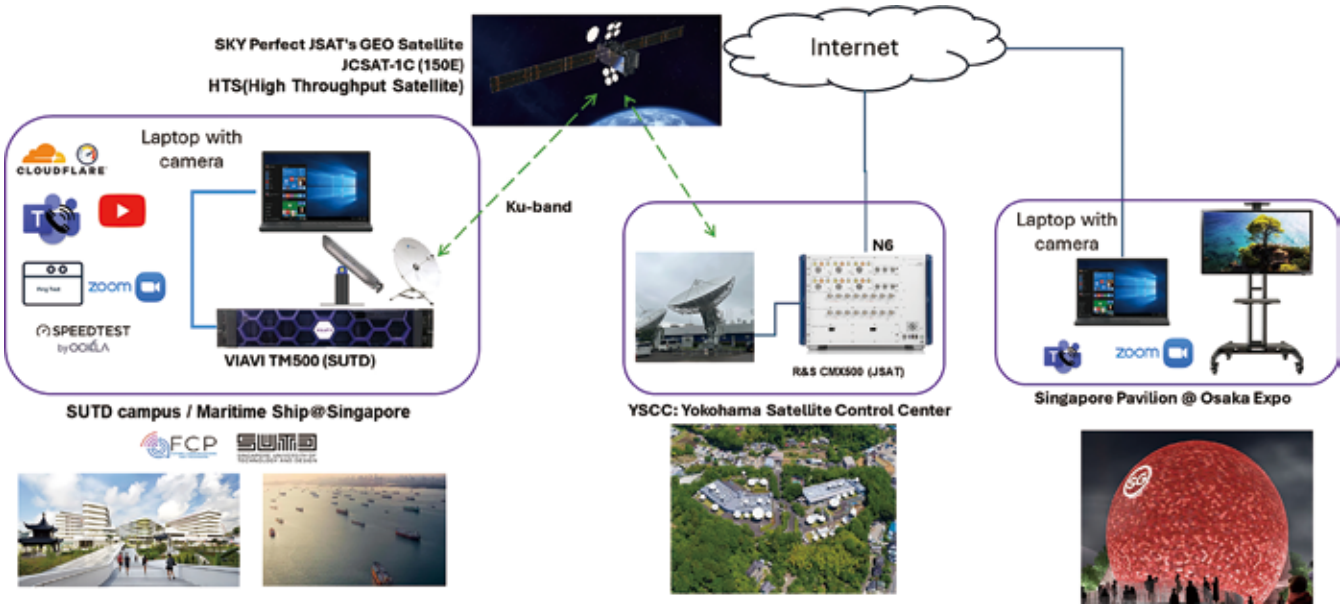
■ Live demonstration at Expo 2025 Osaka, Kansai, Japan

In May 2025, the Republic of Singapore conducted a live video call using a 5G NTN system as a demonstration of future communications at the Singapore Pavilion of Expo 2025 Osaka, Kansai, Japan. SKY Perfect JSAT cooperated in this demonstration via NTN Lab, satellites, technical aspects, etc.

In the demonstration, a circuit was established between

■ Figure 7: NTN Lab facilities

Figure 8: Configuration of live demonstration at Expo 2025 Osaka, Kansai, Japan



Singapore University of Technology and Design (SUTD) in Singapore City and NTN LAB using the JSAT-1C satellite marking the world's first transborder communications by 5G NTN (Figure 8). This demonstration not only verified the operability of a global wireless standard with GEO satellites but also system compatibility between countries based on cooperation. It is an achievement that represents a significant and solid step toward realizing a worldview of Universal NTN™ as envisioned by SKY Perfect JSAT.

5. Conclusion

This article introduced the background to NTN and current NTN trends and described related initiatives at SKY Perfect JSAT. NTN is more than just a technological advancement—it's a vision for a safer, more prosperous, and truly connected society. We believe that by embracing innovation and collaboration, we can help make this vision a reality for everyone.

References

[1] NICT Network Research Institute, NICT Wireless Networks Research Center, Report Issued by the Study Group on the Integration of Satellite Communications and 5G/Beyond 5G
https://www2.nict.go.jp/spacelab/wg/en_Satellite5GB5G_report.pdf
[2] SKY Perfect JSAT Holdings, Inc., "Management Strategy"
https://www.skyperfectjsat.space/ir/policy/business_mission

Cover Art

The Pride of Tokyo's Twelve Months: January, Myogi Visit on the First Rabbit Day of the Year

Tsukioka Yoshitoshi
(1839-1892)

Source: National Diet Library, NDL Image Bank
(https://ndlsearch.ndl.go.jp/imagebank)

= A Serial Introduction Part 2 = Winners of ITU-AJ Encouragement Awards 2025

In May every year, The ITU Association of Japan (ITU-AJ) proudly presents ITU-AJ Encouragement Awards to people who have made outstanding contributions in the field of international standardization and have helped in the ongoing development of ICT.
These Awards are also an embodiment of our sincere desire to encourage further contributions from these individuals in the future.
If you happen to run into these winners at another meeting in the future, please say hello to them.
But first, as part of the introductory series of Award Winners, allow us to introduce some of those remarkable winners.

Kosuke Koiwai

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Fields of activity: Global Standardization on Digital Identities (OpenID, FIDO)

Building a Safer Digital World: Standardization Efforts Toward Digital Identities

I am deeply honored to receive the prestigious Japan ITU Association Encouragement Award. I would like to express my sincere gratitude to the Japan ITU Association and all those involved in related standardization organizations for their continued support.

Several key international standardization bodies play a vital role in the digital-identity domain, including the ITU, FIDO Alliance, Internet Engineering Task Force (IETF), ISO, OpenID Foundation (OIDF), and the World Wide Web Consortium (W3C). These organizations work closely together, and I have primarily contributed through FIDO and OIDF.

As critical online transactions increase, so does the demand for robust mechanisms that perform both identity verification ("Is the person who she or he claims to be?") and authentication ("Is the person the same as in the previous sessions?"). Recent large-scale phishing attacks targeting Japanese financial institutions have made it clear that traditional ID/password-based authentication—even when combined with SMS-based two-factor authentication—is no longer sufficient to protect users.

"Passkeys," standardized by the FIDO Alliance and W3C, have emerged as the only practical phishing-resistant authentication method. I have been active in promoting their adoption and improvement, both through a book I co-authored, "Everything About Passkeys," and through public speaking engagements.

At the same time, identity verification is evolving through standards like ISO 18013-5 (mdoc), also known in Japan as "card-alternative electromagnetic records." These enable simpler and more secure identity verification. As a board member of OIDF and a participant in an expert panel for Japan's Digital Agency, I have worked to enhance global interoperability in this space.

With the support of colleagues worldwide, I remain committed to ensuring that people everywhere can enjoy safer and more secure digital services.

Kazuto Shimizu
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Fields of activity: GSMA NG, 3GPP SA2, MIC Liaison

Successful Formulation of Roaming Guidelines and International Standards for LTE-based IoT Devices

I am honored to receive the ITU-AJ Encouragement Award. It has renewed my sense of responsibility and motivation to make future contributions. I extend my sincere thanks to colleagues in GSMA, 3GPP, and other forums under ITU for their cooperation in developing roaming guidelines and international standards for LTE-based IoT devices.

The GSMA Networks Group (GSMA NG), to which I have been involved since 2015, is resolving issues with network interconnection and roaming by establishing guidelines. At the time I became involved, IoT devices were gaining attention, and I recognized that LTE-based IoT devices had unique communication characteristics compared with traditional mobile phones. I proposed the need for technical guidelines tailored to these devices, especially for roaming scenarios.

In 2017, we launched a dedicated task force with broad support from mobile operators, and I was honored to serve as chairperson. The initial phase was challenging as the deployment of LTE-based IoT devices was still in the early stages. We published a white paper summarizing the features and applications of LTE-M and NB-IoT technologies defined by 3GPP. This required collaboration with device vendors and mobile operators to gather technical details and diverse requirements.

In the second phase, we released the "NG.117 MIoT Roaming Guidelines" in 2018, which defined architecture and configuration values for LTE-M and NB-IoT roaming. I continued as editor until 2019, ensuring the guidelines' relevance and accuracy. These guidelines have also been leveraged to develop subsequent testing guidelines for LTE-based IoT devices roaming.

Discussions in the task force also revealed the need for new specifications to support IoT roaming. As the final addition of my work as chairperson, I proposed and helped formulate additional specifications within 3GPP SA2/CT4.

Looking ahead, I aim to contribute to the international standardization of 6G networks by leveraging my experience in LTE and 5G standardization and national agency liaison.

Yasutaka Suenaga
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Fields of activity: Broadcasting

ITU-R Activities

I am extremely grateful to receive the Japan ITU Association Encouragement Award. I am deeply thankful not only to those at the Association but also all those who have offered guidance and support over the years.

From 2022, I participated in the ITU-R's WP6A and SG6 as a part of the Japan delegation, and I contributed toward international implementation of Japan's frequency standards as well as the standardization of broadcasting technologies.

Among the many activities at ITU-R, the one that left a particularly lasting impression was the SG6 workshop on "Broadcasting in Times of Crisis." It was here that I got to give a presentation on emergency broadcast systems and share Japan's long history of technological and operational knowledge with the international community. The presentation on disaster-prone Japan drew a lot of interest from multiple countries and lead to a fruitful exchange of opinions. In addition, it was an extremely meaningful experience to help deepen international understanding of the important role that broadcasting plays during disasters.

Furthermore, I joined discussions as a representative of Japan in a WRC-23 study group on the topic of reviewing the use of the UHF band in Region 1. This was a particularly difficult topic to reach consensus on among those at WRC-23, so the whole situation was tough, with discussion not proceeding smoothly, the final stage including days off, and sessions continuing from 9 AM to 11 PM. As there were many positions and interests among the various countries, negotiations did not go smoothly. However, by being calm and persistent, Japan was able to get results protecting its broadcasting.

While I have currently stepped away from international work, the knowledge and perspectives I gained during my time with the ITU-R are being put to good use in my domestic work. I graciously ask for your continued support and encouragement as I continue to refine my skills as an engineer to work toward the effective use of radio waves and the further development of the broadcasting field.

Nomination for the Deputy Secretary General of the Asia-Pacific Telecommunity (APT)

- The Government of Japan (GoJ) officially endorsed HORIKAWA Ryo, Director, Global Strategy Bureau, Ministry of Internal Affairs and Communications, as a candidate for the position of the Deputy Secretary General of the APT (for the term from February 2027 to February 2030) in the election to be held at the APT General Assembly in 2026.
- Mr. HORIKAWA has been active in the field of postal and telecommunications policy for more than 20 years, and contributing extensively to international activities and building international personal networks.
- Japan has been a member country since the APT was established in 1979 and is the APT's largest financial contributor. The GoJ is confident in Mr. HORIKAWA's candidacy and remains firmly committed to advancing APT's mission through diverse and ongoing contributions.

Name

Mr. HORIKAWA, Ryo

Present Title

Director, Global Strategy Bureau, Ministry of Internal Affairs and Communications, Japan

Date of Birth

December 28, 1980

Education

- Bachelor of Laws
  University of Tokyo
- Master of Laws
  Georgetown University Law Center

Professional Career

2023	Director, Global Strategy Bureau, Ministry of Internal Affairs and Communications (MIC)
2023	Director, Multilateral Economic Affairs Office, MIC
2020	Vice Mayor / Chief Digitalization Officer (CDO), Miyoshi City, Hiroshima
2019	Senior Principal Deputy Director, Postal Policy Department, MIC
2016	First Secretary, Mission of Japan to ASEAN, Ministry of Foreign Affairs (MOFA)
2014	Principal Deputy Director, Cybersecurity Office, MIC
2013	Secretary to Vice Minister for Communications, MIC
2011	Deputy Director, Postal Policy Office, Financial Services Agency (FSA)
2008	Assistant Director, International Cooperation Division, MIC
2007	Assistant Director, Regional Communications Division, MIC
2003	Joined the Ministry of Internal Affairs and Communications, Japan

Activities for the APT

2023	Chair of the Correspondence Group for the APT Ministerial Meeting (CGMM)
	Chair of the Working Group of Management Committee on APT Legal Instruments (WGMC) [Present]
2025	Vice-Chair of the APT Telecommunication/ICT Development Forum (ADF) [Present]

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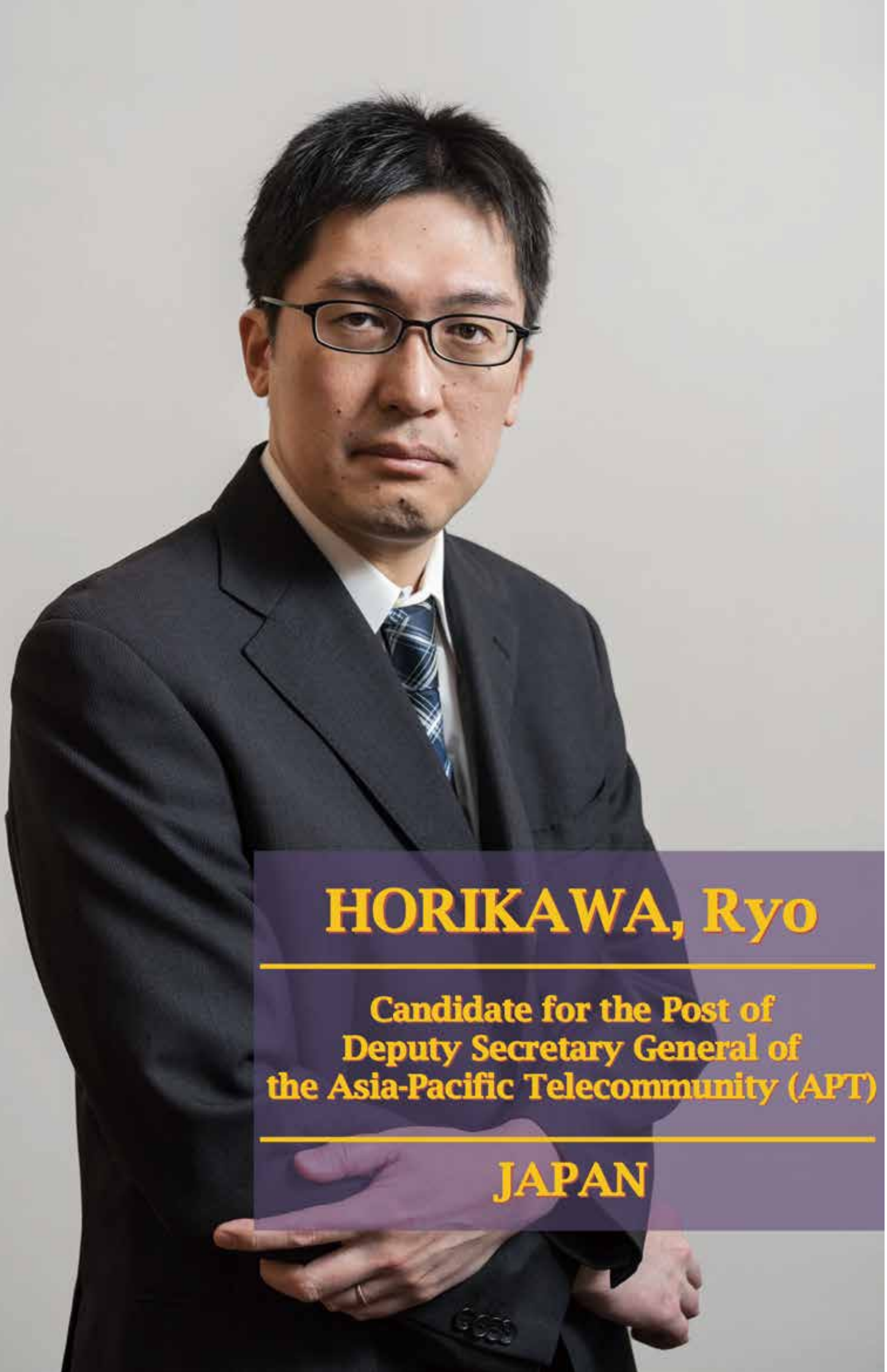

HORIKAWA, Ryo

Candidate for the Post of Deputy Secretary General of the Asia-Pacific Telecommunity (APT)

JAPAN

定価　一冊　一、六五〇円（本体価格　一、五〇〇円、消費税　一五〇円）　年間購読料　六、六〇〇円（本体価格　六、〇〇〇円、消費税　六〇〇円）