資料3－5

ABOUT SPACEX

- Founded in 2002 to make humanity interplanetary
- Pioneered rocket reusability
- Over 113 launches so far in 2025, with 2900+ satellites put into orbit
- Largest satellite constellation in terms of capacity and connected users by far

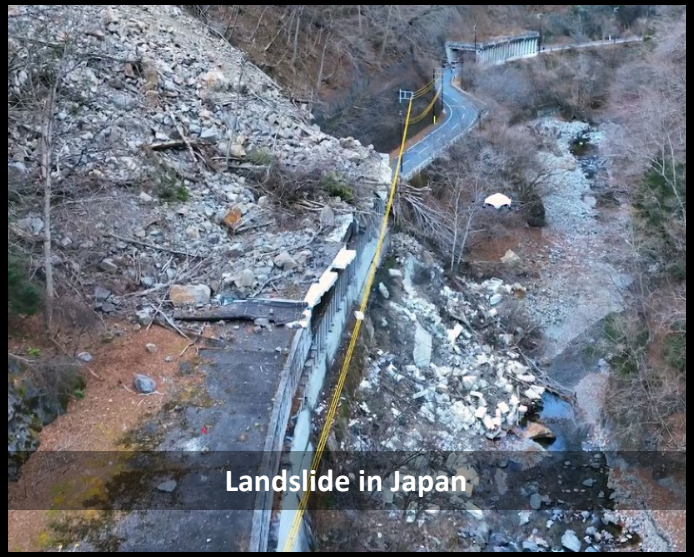
STARLINK SERVICE

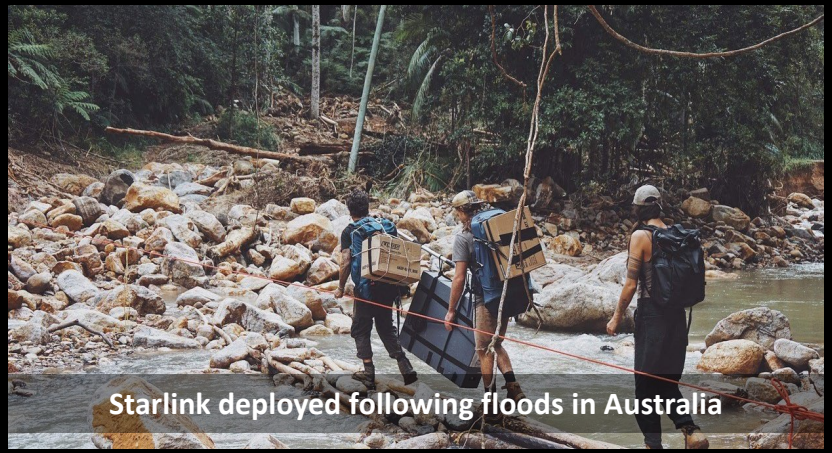
- Providing low-latency, high-speed connectivity to over 8 million customers globally
- 8000+ active satellites
- Live in over 150 global markets!

EMERGENCY RESPONSE

- Starlink can be rapidly deployed to maintain connectivity immediately after natural disasters to support relief efforts anywhere in the world.
- Used in recent disaster relief in the USA (hurricanes, fires).


Volcanic eruption in Tonga


Landslide in Japan

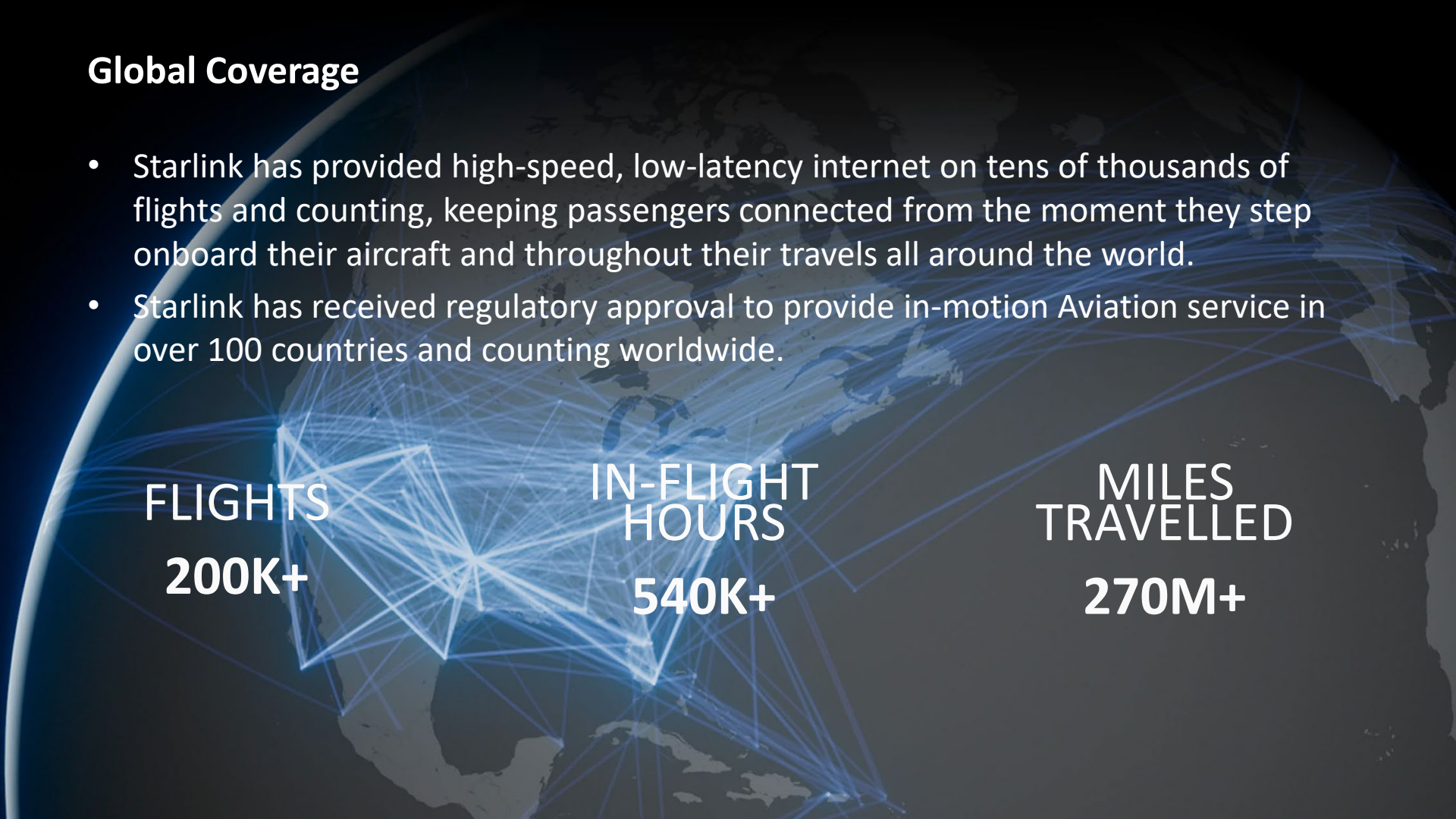

Starlink deployed following floods in Australia

What is Starlink ESIM?

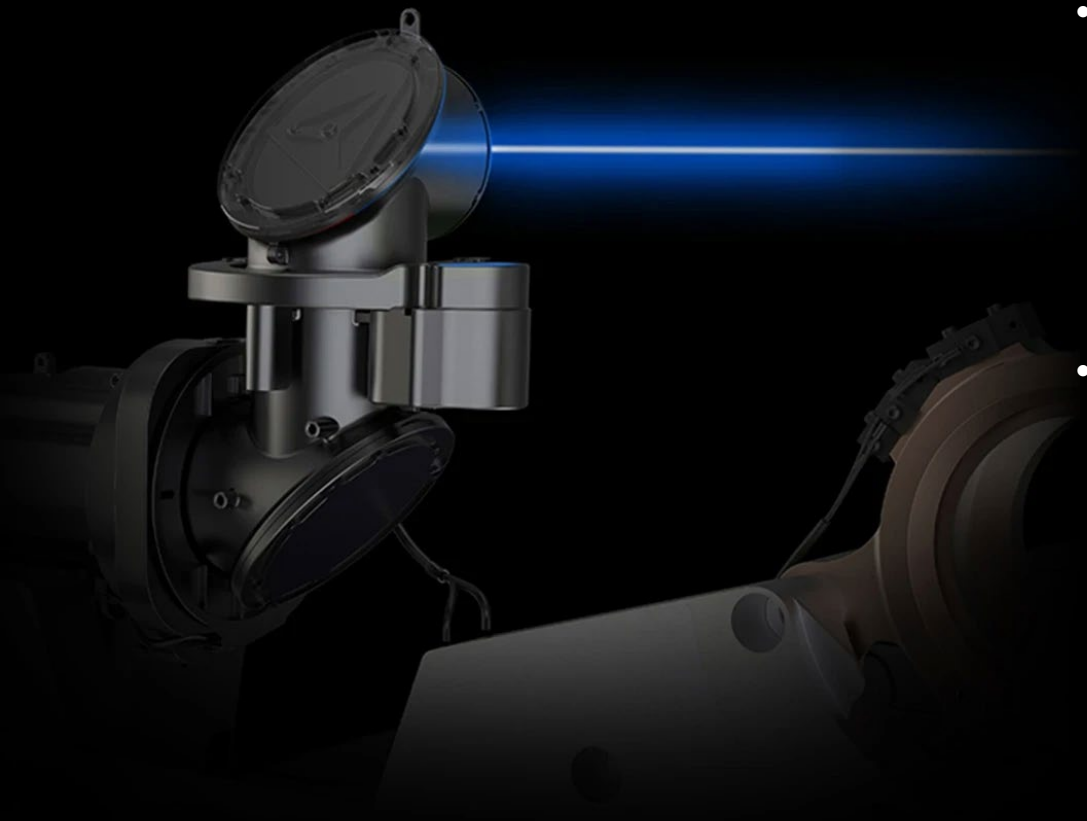
- Starlink is currently being utilized by a variety of vehicles across land, air and sea to provide connectivity on-the-go.
- Trains, cars, aircraft, drones and all other kinds of vehicles can benefit from Starlink's robust satellite connectivity.
- A notable use case is Starlink Aviation, which offers high-speed, low-latency in-flight internet with expansive coverage.
- Delivering download speeds of 100–250 Mbps (with peaks up to 450 Mbps), upload speeds of up 10-25 mbps, and average latency under 35 ms, Starlink enables all passengers to enjoy activities such as video streaming, video calls, and online gaming—simultaneously.
- Starlink has connected over 1350 aircraft to date and continues to ramp up as more airlines seek access to this "sky"-breaking technology.

Global Coverage

- Starlink has provided high-speed, low-latency internet on tens of thousands of flights and counting, keeping passengers connected from the moment they step onboard their aircraft and throughout their travels all around the world.
- Starlink has received regulatory approval to provide in-motion Aviation service in over 100 countries and counting worldwide.

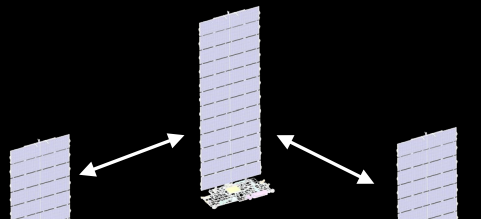


Laser Mesh Network



- Starlink’s optical space lasers transmit data throughout the Starlink constellation, providing continuous service in areas far from SpaceX ground stations - providing coverage for flights over the open ocean and in polar regions.
- Starlink's constellation contains 9,000+ lasers transmitting 10Pb+ of daily data traffic. These lasers can sustain a 100Gbps connection per link, can connect up to 5,300+ km (3,300 mi) apart, and maintain a mesh network with 99.99% uptime.

Starlink Architecture Diagram



Intersatellite Links

Ka-Band
DL: 17.8 – 19.3 GHz
UL: 27.5 – 30.0 GHz

Ku-Band
DL: 10.7 – 12.7 GHz
UL: 14.0 – 14.5 GHz

Data Center

Datacenter cross connects

Internet Point of Presence (PoP)

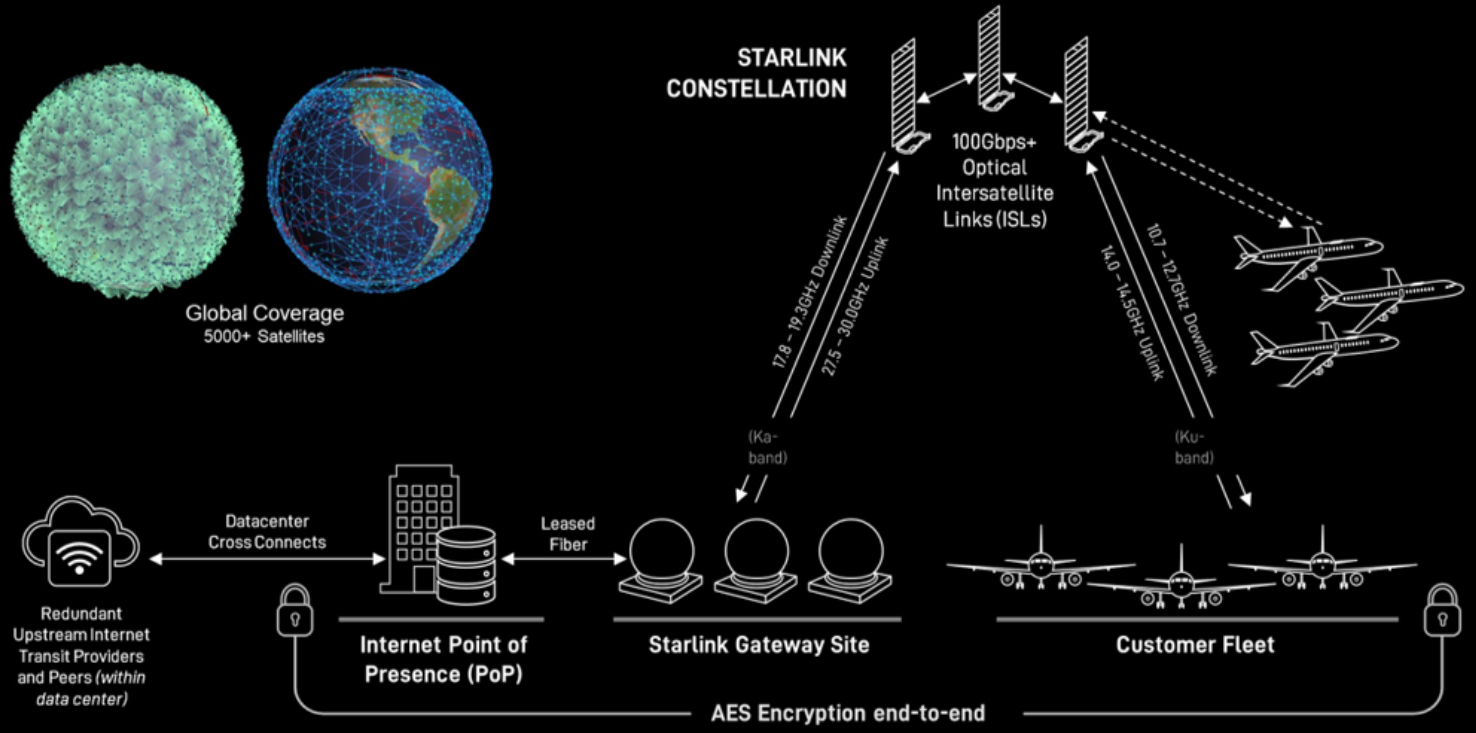
Fiber

Gateway Site

Starlink User Terminal

E2E Encryption

Starlink Aviation Architecture



Specific regulations where relaxation / new framework would be most impactful

PFD constraints below ~3,000 m

- Current PFD masks (Article 262-2) restrict LEO ESIM operation below ~3000m, limiting service in land and aviation environments. A framework that allows controlled, coordinated LEO operation below ~3,000 m would unlock significant benefit for Japanese airlines and other in-motion users and use-cases.

Use of the full 14.0–14.5 GHz band for aeronautical ESIM

- Today's blanket license framework primarily covers the 14.0–14.4 GHz band. To provide performance consistent with other Starlink-equipped airlines globally, access to the full 14.0–14.5 GHz range for aeronautical ESIM in Japan is important, aligned with the coordination Starlink is already conducting with existing Ku-band fixed and mobile services. Even if the upper 100 MHz is phased in later, having a clear regulatory path and conditions defined in advance is critical for airline planning, aircraft modification, and long-term product design.

Current Regulations

Issues:

- Is it possible to comply with the PFD limits specified in Article 262-2, Item 3 of the Radio Station Operation Rules when operating at altitudes of 0–3,000 m?

Key Points:

- Earth stations (airborne) operating in the 14.0–14.4 GHz band essentially meet the PFD limit conditions referenced by the Satellite Communication Systems Committee in ECC Decision (18) 05.
- ECC Decision (18) 05 sets rules for 14.25–14.5 GHz to protect terrestrial fixed stations sharing the same channel, and the committee report focuses on 14.4–14.5 GHz.
- Regarding frequency allocation in Japan, there is no allocation of fixed stations in 14.0–14.4 GHz.
- However, Article 262-2, Item 3 of the Operation Rules adopts the same PFD limits as ECC but applies them to 14.0–14.5 GHz.
- Consequently, even though airborne earth stations using 14.0–14.4 GHz do not share the same channel with terrestrial fixed stations and can protect them operating in 14.4 GHz at altitudes of 0–3,000 m, they still fail to comply with the operation rule. (See next slide)

<Article 262-2, Item 3 of the Radio Station Operation Rules>

“When operating a mobile earth station mounted on an aircraft using radio equipment specified in Article 49-23-5 of the Equipment Regulations, the maximum power flux density at the Earth's surface shall not exceed the values listed in the upper row of the following table. Furthermore, based on the angle of arrival of radio waves relative to the horizontal direction at the Earth's surface, operation shall not exceed the values listed in the lower row of the same table.”

Angle of Arrival (θ)	Power Flux Density
5 degrees or less	(-)122 dB/m2/mHz
More than 5° up to 40°	Value not exceeding the formula below: -127 + θ dB/m2/mHz
More than 40° up to 90°	(-)87 dB/m2/mHz

Suggestions

- Do not change the rule; instead, amend the radio station examination standards, which is internal rule in MIC, to state that for aeronautical ESIM, compliance with PFD will be confirmed only for frequencies above 14.4 GHz.

- After showing compliance in adjacent bands, earth stations in 14.0–14.4 GHz can operate at 0–3,000 m without issue.

- **No operational rule change is necessary.**

Examples of usage in other countries (Europe / United States)

- Aviation is one of the most prominent ESIM use cases, where high-speed continuous Starlink-equipped aircraft significantly enhances the passenger experience.
- In both the United States and Europe, Ku/Ka-band ESIM (including LEO systems) is already authorized on commercial aircraft across all normal flight phases, based on PFD masks derived from ITU/CEPT work and supplemented by coordination and installation requirements. For Aviation ESIM for example, passengers on many Starlink-equipped aircraft already enjoy gate-to-gate connectivity as standard.
- Several North American and European airlines using Starlink have adopted a "high-speed Wi-Fi for every passenger" model, made possible by LEO's capacity and latency characteristics.
- We hope to bring the same level and quality of service to Japanese airlines and other innovative Japanese use-cases.


Thank You!