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Low Earth Orbit Satellite  
Connectivity and Spectrum

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## Space is the future for communications on Earth.

- OneWeb is building an unparalleled end-to-end LEO system that will supply broadband-style data speeds to every part of the world.
- Our network is in its final phase of deployment to meet this truly global connectivity challenge.
- Full global coverage expected in 2023.



# Space, Ground and Operational Execution underway



## Priority spectrum

- 6.0 GHz of Ku-Band (2.5GHz) & Ka-band (3.5GHz) secured



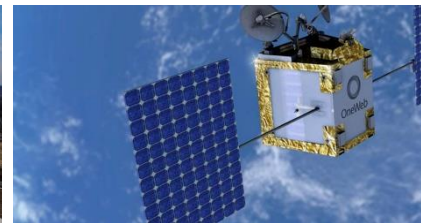
## High-volume satellite manufacturing factory

- Total of 648 satellites to be delivered



## Monthly launch cadence

- 13 Launches complete
- Launches resume later in 2022



## LEO Constellation

- 427 of 648 in orbit



## Production UTs

- Supply chain readiness



## Global deployment of ground infrastructure

- 9 ground stations operational
- 14 underway
- 45+ total



## Ground and Fleet operations Centres

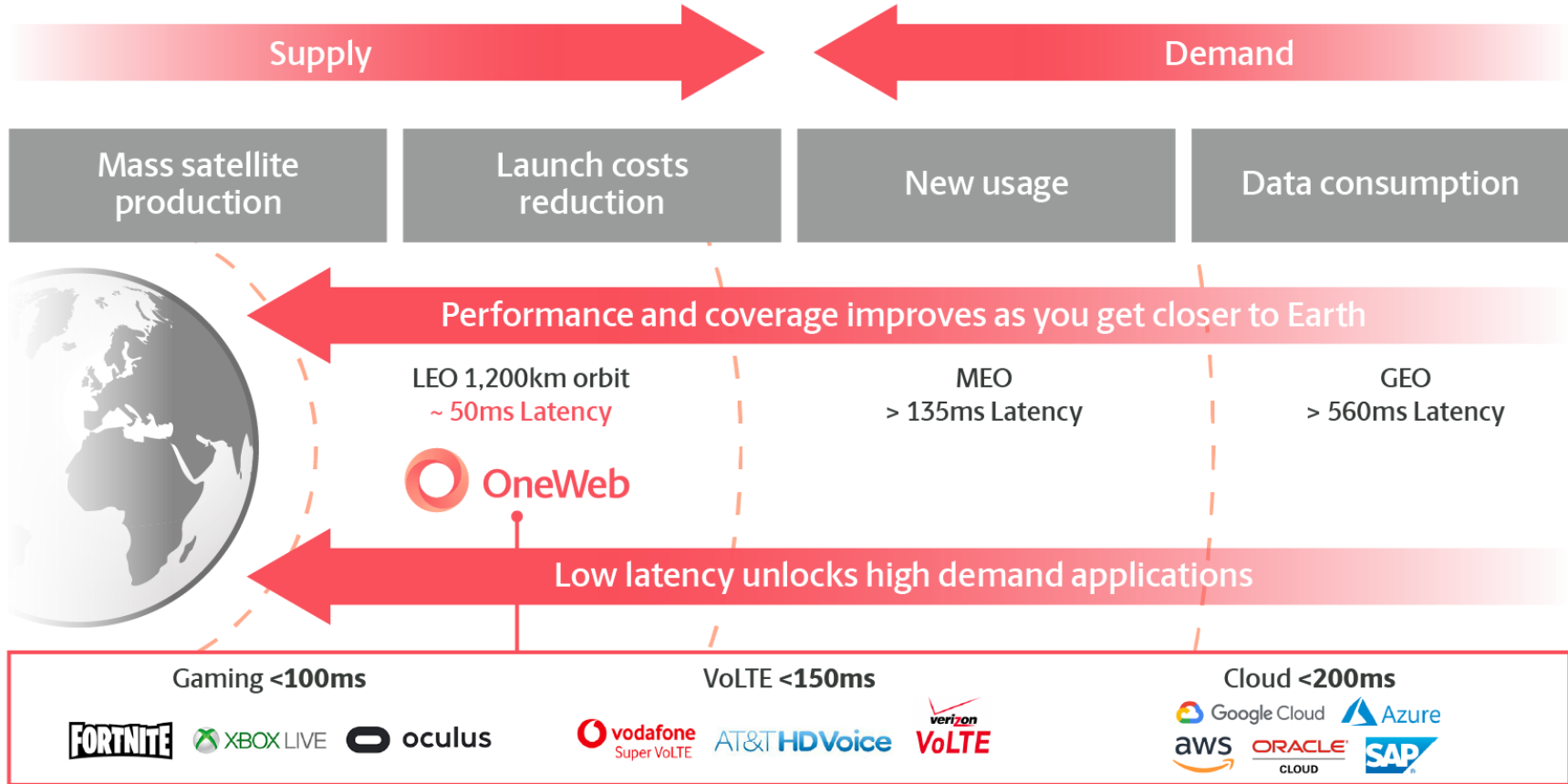
- Operations centres in London and VA, USA



## Digital Products and Customer Operations

- Ready for Commercial Service In 2022

# Disrupting satellite communications

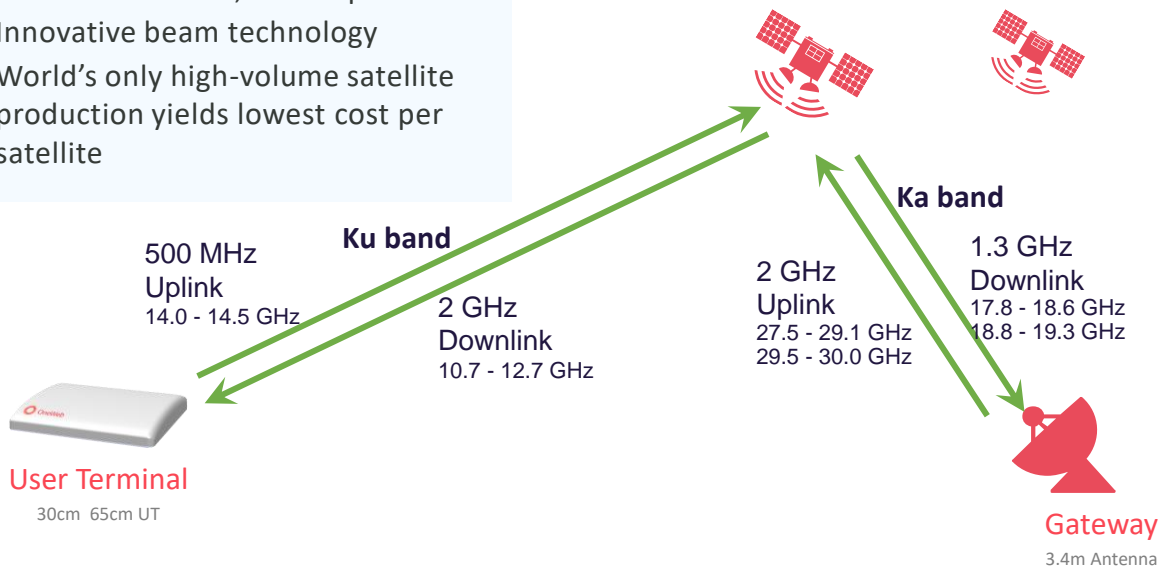


# How it Works



## Space

- 650 LEO satellites; orbital planes
- Innovative beam technology
- World's only high-volume satellite production yields lowest cost per satellite



## Ground

- 45+ Gateways across the globe
- A range of UTs to meet varying markets
- Many can be easily installed without position aiming
- Operations Centers in London and Virginia

# mmWave usage in Satellite Industry

Ku- Ka- band are vital bands for Satellite industry, V/E-band is the future

## Ku band

- Fixed Satellite / Gateways
- NGSO Earth Stations Terminals (fixed, on the pause, or on the move)

10.7-12.7 GHz

- Broadband connectivity is essential for passengers on the move. Aviation, maritime and other land mobile vehicles such as trains, or emergency vehicles, are also using satellite broadband services.

## Ka band

14-14.5 GHz

- Over the last 15 years, the ECC has issued a number of decisions validating the operation of fixed and mobile satellite earth stations in the Ku and Ka bands

17.8-19.3 GHz

27.5-30 GHz

- Congestion in Ka band with over 130 GSO satellites and several NGSO constellations.

## V-band

37.5-43.5 GHz

47.2-50.2 GHz

50.4-52.4 GHz

- The satellite industry is looking at Q/V as the new frontier.
- 5.516B identifies 40-40.5 in all 3 Regions for ubiquitous deployment of HDFSS, Region 1 also has 39.5-40 GHz and 47.5-47.9 GHz, and Region 2 has 40.5-42 GHz
- OneWeb is in the FCC processing round and ITU fillings, with intention for feeder links

## E-band

71-76/81-86 GHz

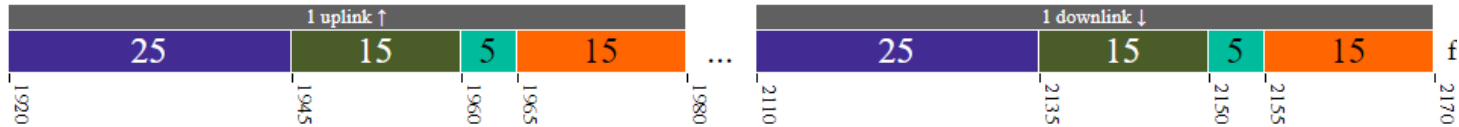
- WRC-27 will study this band for non-geostationary fixed-satellite system feeder links.

**It is important for industry that governments provide assurances of stability and spectrum availability. Interference prevention is critical to provide industry the confidence to invest in technology development**

# Mechanism of spectrum assignment

## Mobile

- Country/region wide service
- **Exclusive usage**, if one operator has license, it is illegal for another operator to use this frequency.
- Various bands licensed to the same MNO, used in same handset
- Base-stations select the portion of the bands they must use.
- Neighbouring countries have cross border agreement (between operators or between countries)
- Easy to stop signal at country border with base station down-tilting, shielding etc.

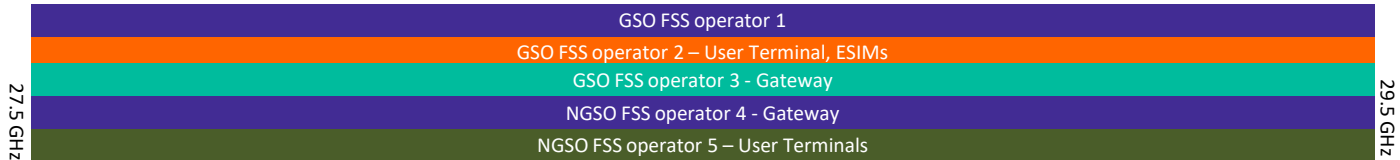


Usually demand for exclusive use is greater than supply, therefore market based mechanism is appropriate: auction, beauty contest, etc.

# Mechanism of spectrum assignment (cont.)

## Satellite

- Often different bands for user terminals and gateways
- In case of gateway, only used at specific location.
- **Non-exclusive usage.** Several satellite operators can be using the same band.
- Coordination between satellite operator to prevent interference.
- **Spectrum coordinated at global level**
- Clear coordination rule set in ITU radio regulation on who is responsible to coordinate.



**Administrative assignment only. Never any example of auction of spectrum for fixed satellite service (not to confuse with auctions of GSO orbital slots)**

**Assign a spectrum that can easily be shared among multiple users for exclusive usage would be waste of precious resources and inefficient spectrum management, hurt consumers**



Following current ITU framework and Coordination Procedures, 99.95% of spectrum assigned to satellite networks was free from reported harmful interference.

## **GSOs/NGSO**

ITU RR Art 22

EPFD for protection of GSO

One way the ITU ensures sharing is to limit the power emitted by NGSOs when pointed towards the GSO arc/orbit.

OneWeb implements GSO arc avoidance with a progressive pitch around the equator

## **NGSO/NGSO**

Coordination is required between NGSOs, and coordination procedures from ITU Radio Regulation should be followed.

Until a coordination agreement is signed between two NGSO systems, the ITU Radio Regulations requires the later-filed system to eliminate any harmful interference into the earlier-filed system (RR No 11.42).



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# Optimize Regulation and support innovation



1. **Embrace Innovation and Innovative Technologies:** choose infrastructure solution based on merits.
2. **Spectrum Access requires Certainty and Fairness:** critical connectivity (e.g. BB4All, Disaster relief, eHealth or eEducation) not evaluated on economic grounds.
3. **Put consumers first, avoid protectionism and embrace competition:** domestic and foreign operators on equal footing.
4. **Embrace “Open Sky” and “reciprocity” policies:** commercial or technical presence are not imposed.
5. **Transparent and time-bound application process:** License and authorization process to be streamlined and simplified.
6. **Encourage blanket licensing and free circulation:** one single entity is licensed for a large number of VSATs/Satellite terminals.
7. **Taxes and Fees should be reasonable** limited to recovery of the regulator’s administrative costs
8. **Exchange & follow best practices:** develop regionally harmonized approaches together with other regulators.

**Regulation is a means to an end: helps to develop competition and serve the goal of closing “digital divide”**