AST SpaceMobile

Transforming how the world connects -
Satellite direct to existing handsets

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Agenda

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AST SpaceMobile

AGENDA

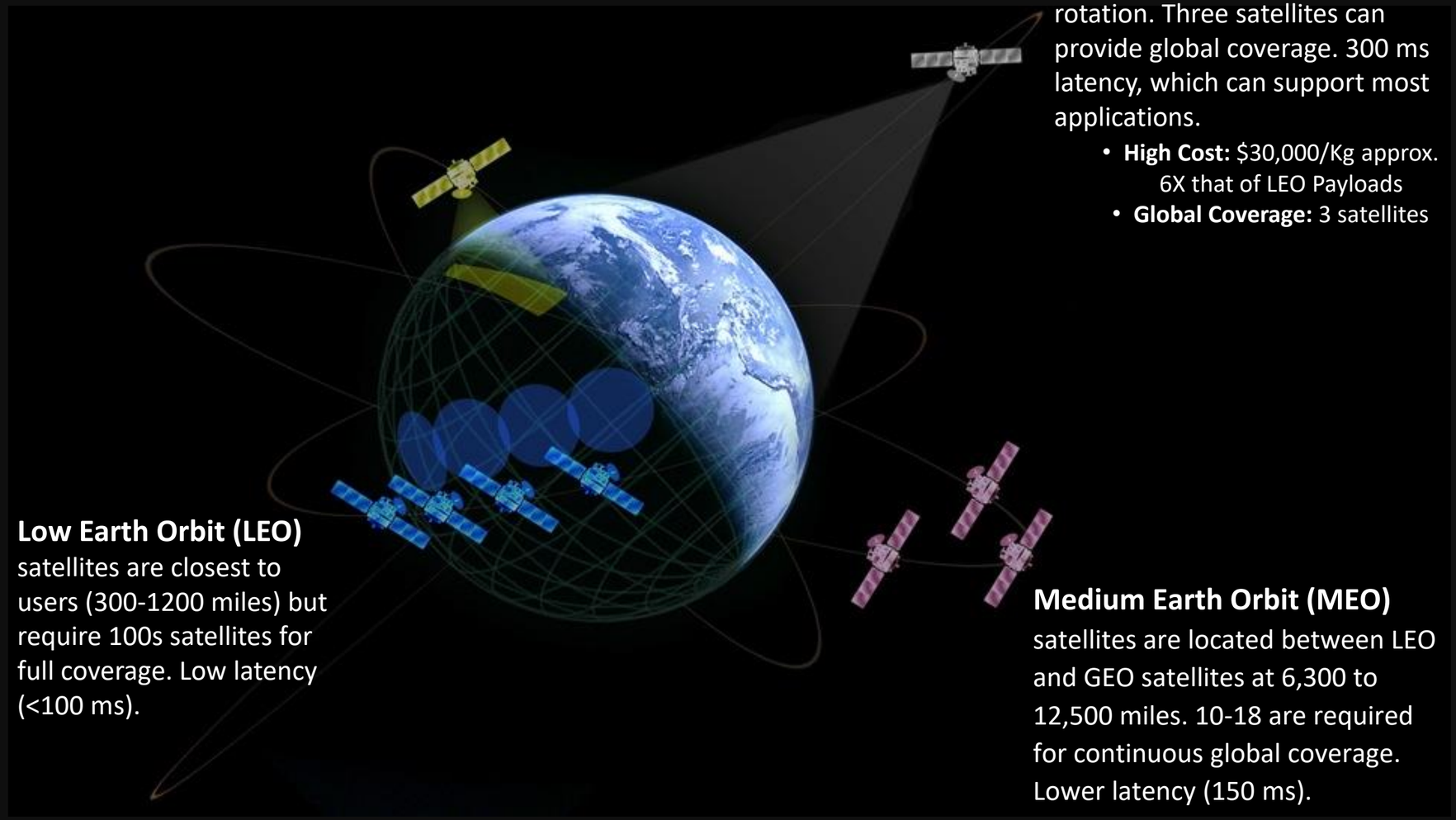
1. Introductory Remarks: Vikram Raval
   Head of Global Regulatory Affairs, AST SpaceMobile

2. Presentation: Paul Nalikka
   VP, Africa

- GEO, MEO, LEO
- AST SpaceMobile
- Socio-Economic Benefits

Satellite Segments

GEO, MEO and LEO



Geosynchronous (GSO)

satellite orbit (36,000 km) rotates at the same speed as the Earth's rotation. Three satellites can provide global coverage. 300 ms latency, which can support most applications.

- **High Cost:** $30,000/Kg approx. 6X that of LEO Payloads
- **Global Coverage:** 3 satellites

Low Earth Orbit (LEO)
satellites are closest to users (300-1200 miles) but require 100s satellites for full coverage. Low latency (<100 ms).

Medium Earth Orbit (MEO)
satellites are located between LEO and GEO satellites at 6,300 to 12,500 miles. 10-18 are required for continuous global coverage. Lower latency (150 ms).

Source: Policy – Satellite Industry Association, Washington, D.C. (sia.org)
GSM

Orbit Comparison

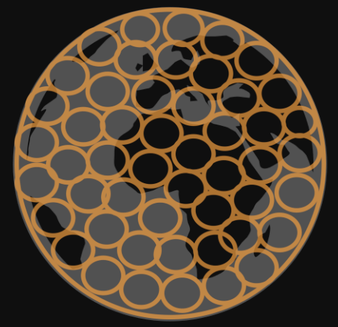
GEO: 1 satellite covers 1/3 of the world.

MEO: 8 satellites can cover 2/3 of the world.

LEO: hundreds of satellites cover 100% of the world.

36,000 Km

6300– 12500 Km



200 – 2,000 Km

Latency Comparison - LEO Offers Lowest Latency

PERFORMANCE IMPROVES AS DISTANCE FROM EARTH DECREASES

LEO
~ 50ms

SpaceMobile (AST&Science)

OneWeb

StarLink (SpaceX)

Kuiper (Amazon)

LightSpeed (Telesat)

MEO
> 135ms

O3b

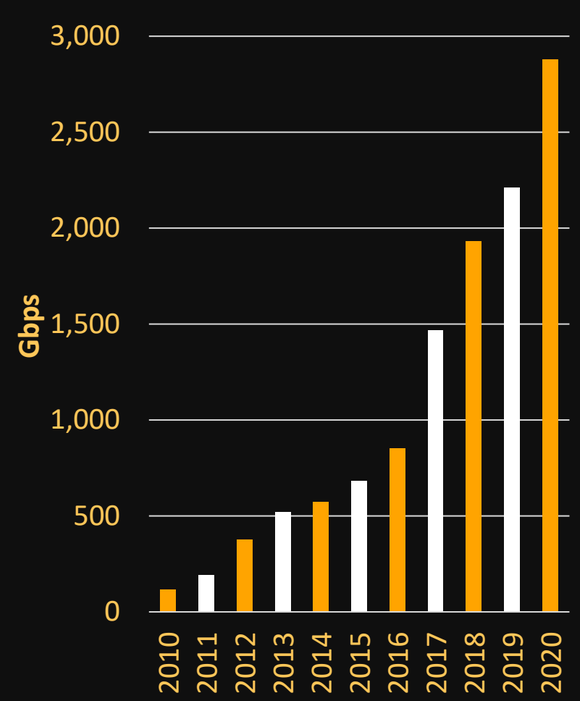
GEO
> 560ms

Traditional satellites (Intelsat, Inmarsat, NigComSat, KazSat, etc.)

BUT NEED MORE SATELLITES TO COVER SAME FOOTPRINT AS ALTITUDE LOWERS

LEO Offer Broadband Capacity

High-Throughput Capacity → Cost Per Bit Decreasing → LEO Satellites Fill a Tech Gap



As costs decrease:

Launch costs

Manufacturing costs

Time to market

Bits increase:

Technology improvements

Processing power

Broadband: User experience and price are competitive with wireline: ideal for hard-to-reach regions

Mobility: Provides broadband experience everywhere for passengers and crew

Telco: Extends networks, offloads congestion, and price competitive with microwave

Enterprise: In-office broadband experience in remote locations

Satellite Innovation

Trends and Patterns

Adapted Policy – Satellite Industry Association, Washington, D.C. (sia.org)

High-throughput satellites use spot beam technology

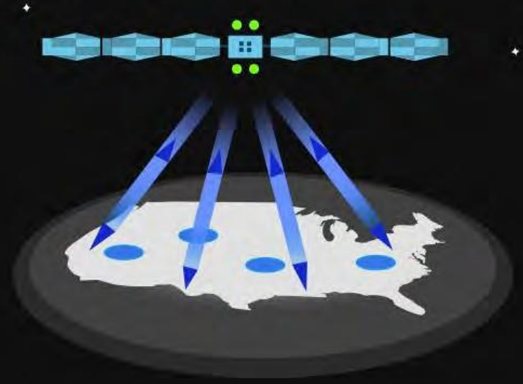
Dynamic spectrum use allows for re-use of spectrum to most-needed areas

Lower cost flat-panel antennas have been developed to enhance broadband communications

Constellations of tens to thousands of smaller NGSO satellites will provide low-latency broadband worldwide

Cost per Mbps with GEO have decreased dramatically and continues with LEO constellations driven by technology and launch cost reduction

Single beam, one-way video broadcast



Spot beams for satellite internet

Development of NGSOs Since 1990”s

Engineers have always known LEO was better for voice, but the demand was too low.

Teledesic, ICO, and Skybridge emerged in the late 1990s and tried to build constellations of hundreds of satellites…

Today, Iridium and Globalstar offer voice and low-speed data satellite solutions focused on specific markets

O3b, now part of SES, is a MEO and provides services to about 45 degrees N/S

OneWeb, Starlink, Kuiper and the other LEOs can cover the globe with low latency and mobility.

Expanding beyond traditional satellite end markets

Existing satellite communications businesses have served the needs of narrow customer segments, but LEO's AST SpaceMobile will meet the needs of the mass market

	Direct satellite connections via specialized mobile phones	Indirect satellite connections via complex, expensive hardware		First and only direct satellite broadband to mobile phones
				
	Provider-specific satphones (~$1K)	Provider-specific antennas mounted on planes, ships, vehicles, buildings (~$1K-$200K+)		Any standard mobile phone
Providers	Globalstar, inmarsat, iridium	Today: eutelsat, SES, TELESAT, Viasat, INTELSAT, iridium, inmarsat	Coming: SPACEX, amazon Project Kuiper, OneWeb	AST SpaceMobile
End users	Those with narrowband service on satphones	Enterprise, maritime, aviation, government, residential		Mass market mobility and the unconnected

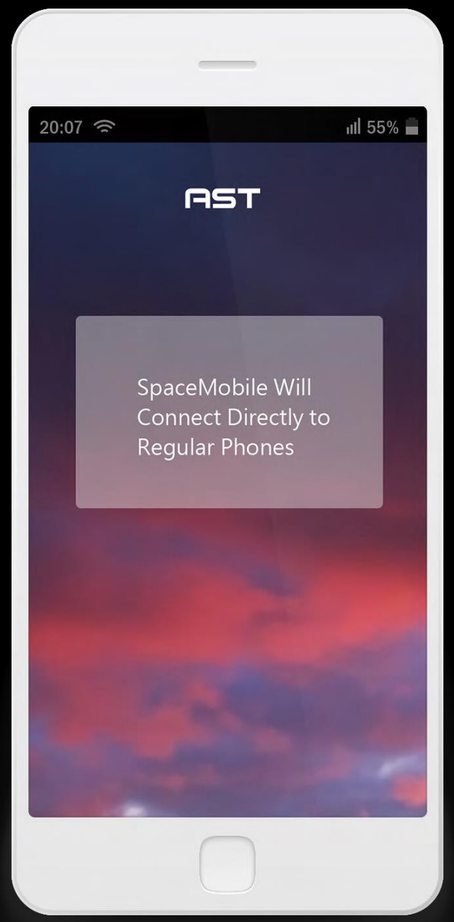
Today's NGSOs build on that experience

Now, with the internet and personal mobility, the demand has skyrocketed at the same time the technology has developed and lowered in cost.

	AST SpaceMobile	OneWeb	SES O3b mPOWER	SpaceX / Starlink	Telesat Lightspeed	Amazon Project Kuiper	China SatNet
Constellation Size	168	588 (gen1) (438 launched)	11	4,409 (Gen1) (>1,900 launched)	298	3,236	6080 Gen1 12,992 Gen2
Frequency Bands	Cellular (fronthaul) Q/V (backhaul)	Ka gateways Ku users	Ka	Ka gateways Ku users	Ka	Ka	Ka (maybe also V, G)
Orbit	~700 km	1,200 km	8,063 km	350-550 km	1000 Km	600 km	590-600 km 1145 km
Capacity	Confidential	~5 Tbps (~7.5 Gbps/sat)	~2.7 Tbps (~200-315 Gbps/sat)	~75 Tbps (~17 Gbps/sat)	~12 Tbps (20-50 Gbps/sat)	~30-32 Tbps	
Target Markets	MNOs (and their subscribers)	Wholesale, B2B, backhaul, enterprise, government, mobility	Backhaul, trunking, energy, cruise, aero, government	Residential broadband, government	Backhaul, Mobility, Enterprise, government	Residential broadband, enterprise, Backhaul, mobility	Belt & Road diplomacy

AST SpaceMobile

AST SpaceMobile Case Study



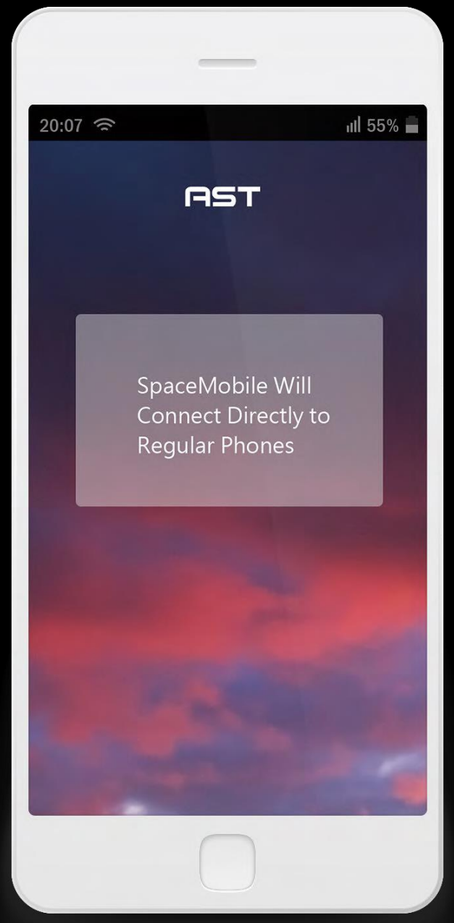
Transforming connectivity with satellite direct-to-device technology

Phones, Devices, Wearables, IoT

Phones ▪ **Devices** DIRECT-TO-DEVICE **Wearables** ▪ **IoT**

UNMODIFIED ▪ ***STANDARD*** ▪ ***EXISTING SPECTRUM***

AST SpaceMobile



Space-based
cell towers planned for cost-effective extension of mobile network coverage

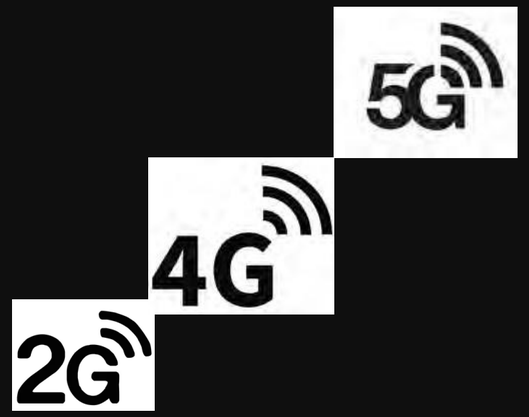
Coverage everywhere
Eliminate cellular coverage gaps and dropped calls

Broadband data speeds
High data rates with low-latency, cellular-quality service levels

Compatible with all
Existing 5 billion mobile phones, providing seamless service without modifications

Connecting the unconnected
Be affordable to all, including rural and underserved

What is AST SpaceMobile?



AST SpaceMobile is building a new LEO satellite constellation to enable existing MNOs to provide mobile broadband coverage directly to standard mobile devices and smartphones

- A space-based cell tower company that partners with nationally licensed MNOs to extend their existing terrestrial infrastructure
- Aims to fill coverage gaps to connect the unconnected, reduce the digital divide, and plans to deliver affordable cellular broadband to 100% of the population and geography
- AST's customer is the MNO
- With our solution, the MNO uses their already licensed spectrum in a self-interference management process

- End users purchase the service from the MNO partner and use existing mobile devices
- Supports cellular services at 2G, 4G and 5G speeds for any MNO
- National MNOs continue to hold all domestic national regulatory responsibilities for mobile services
- Flexible business model and affordable market-based pricing

AST SpaceMobile Helps Solves a Problem

Source: space.com.

5 billion mobile phones in service today could have coverage even when not in range of cell towers

What problem does SpaceMobile solve?

- Broadband connectivity to existing mobile phones when out of range of cell towers
- Affordable broadband data, voice and text services to those in rural and remote areas without cellular coverage
- Public and private connectivity goals and regulatory requirements that seek to bridge the digital divide
- Ongoing connection of emergency services and populations during natural disasters

Why is SpaceMobile different?

- World's first and only space-based cellular broadband network
- Broadband connectivity directly to unmodified mobile phones, with no separate, costly ground antenna or specialized phones
- Dramatic expansion beyond traditional markets for satellite technology

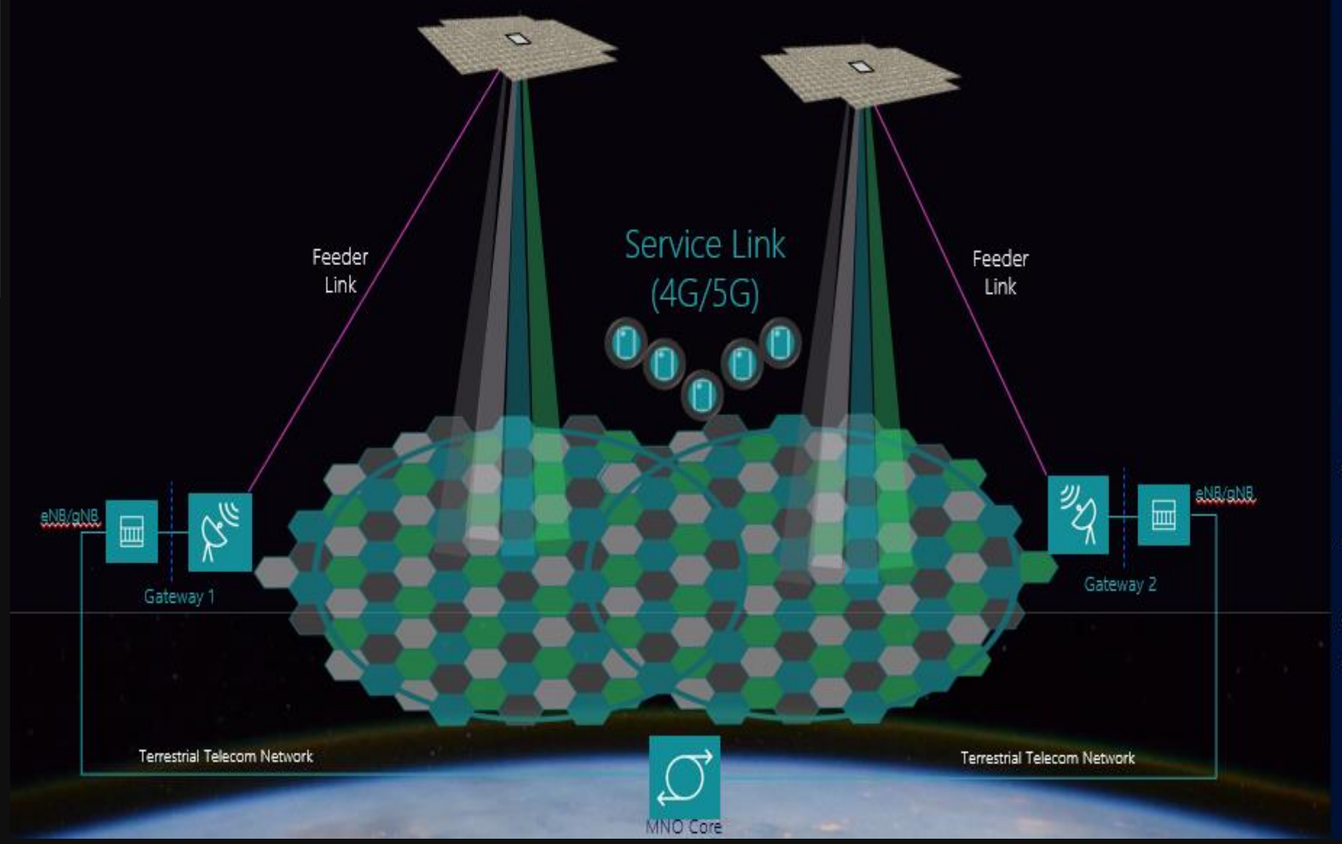
Why now?

- 5 billion mobile phones in service today
- Advances in miniaturization and reduced power needs are driving low-latency, low earth orbit satellite system architecture
- Broadband is increasingly a human necessity

Ground Connectivity in Space

Source: AST-Nokia@MWC2023

AST SpaceMobile will offer connectivity from low Earth orbit like cell towers in space



Technical Details

- Service link based on MNO spectrum
  - e.g. 698-960 MHz and 1.7-2.2 GHz
- Sat Footprint: 780,000 square km
- Sat Cell size:
  - 48Km (low band)
  - 24Km (mid band)
- Fixed beam operation
- Q/V band feeder link
- Connect standard / unmodified UE's
- Use of MNO Core Network
- Transparent architecture

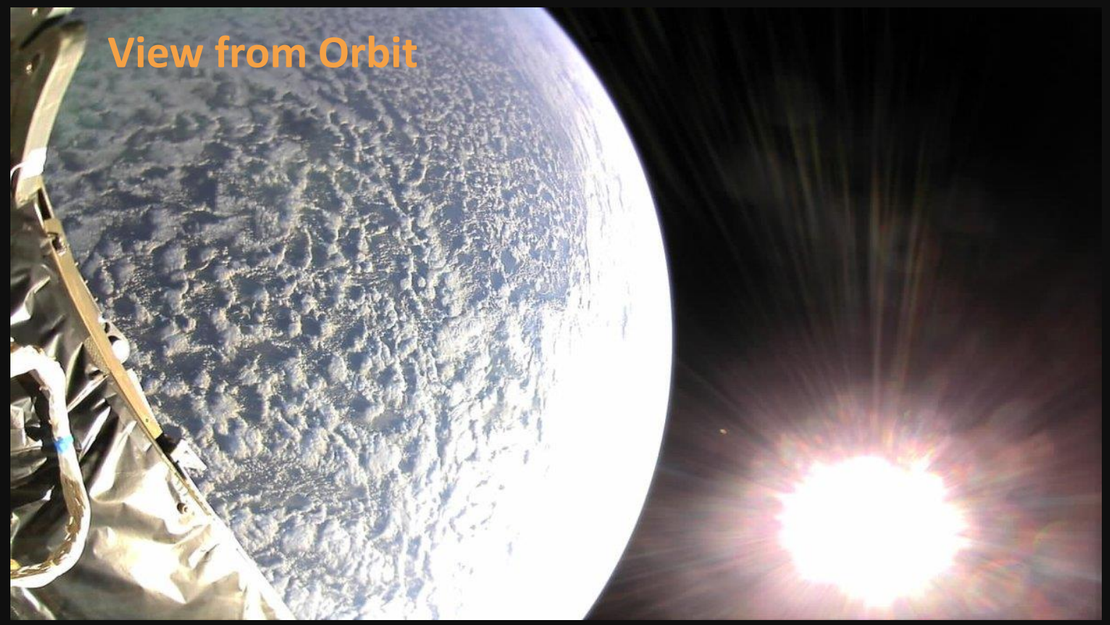
Operational Details

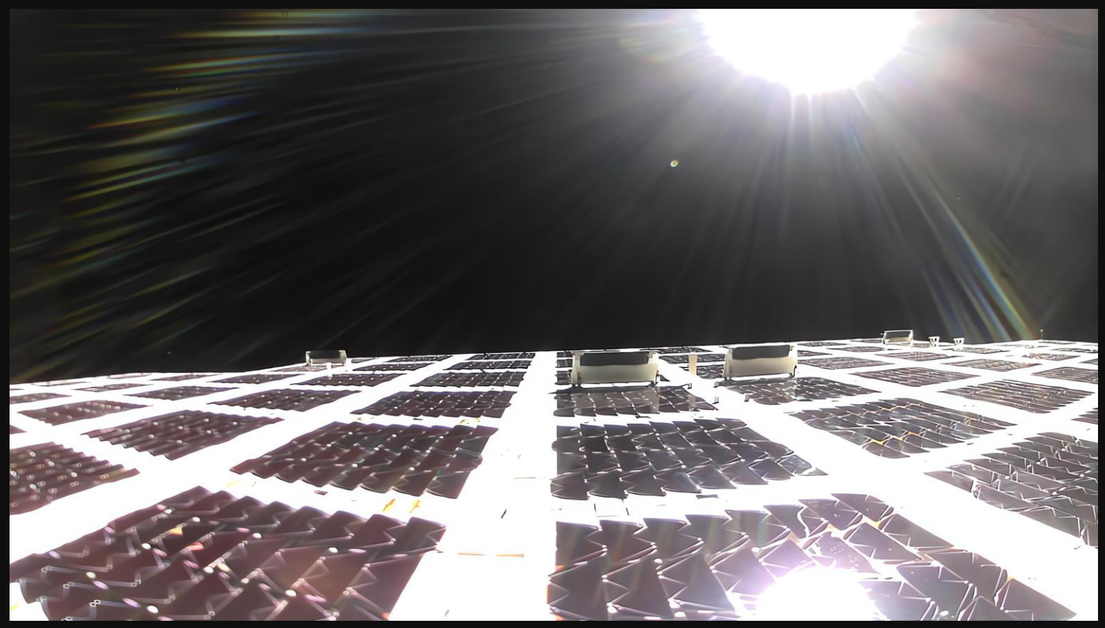
- MNO uses their already licensed spectrum in a self-interference management process
- End users purchase the service from the MNO partner
- AST SpaceMobile's customer is the MNO
- National MNOs continue to hold all domestic national regulatory responsibilities for mobile services

BlueWalker 3
Launch September
10, 2022

Critical technology milestone achieved

Mechanical unfolding of the largest-ever communications array in low Earth orbit



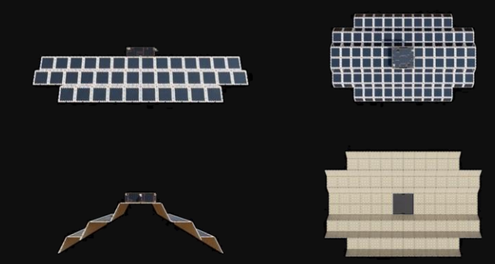


BlueWalker 3 test satellite update

Initial test results indicate downlink signal strength necessary to reach 5G cellular broadband speeds

Satellite Deployment

✓ Deployed the largest-ever commercial communications array in low Earth orbit

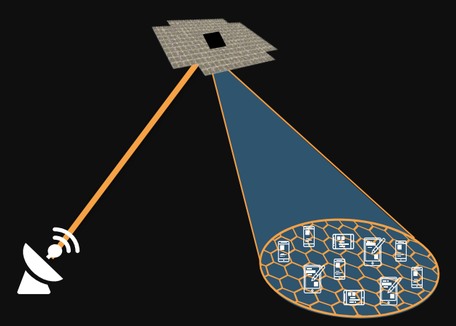


Satellite Flight Control

✓ Proven ability to fly and control BW3 with fully deployed array (693 sq ft)

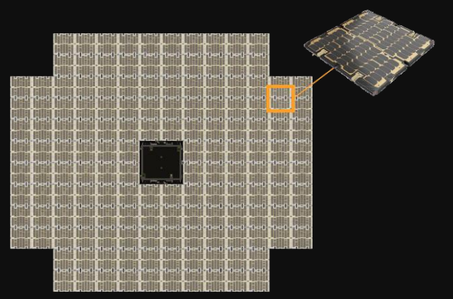
Patented Technology

✓ Validated our patented doppler and delay compensation



End-to-End Testing

❑ Targeting to complete cellular 4G LTE broadband speeds direct to standard, unmodified phones



Historical first voice call to unmodified Samsung smartphone with BlueWalker 3

Close collaboration with AST Partners

vodafone

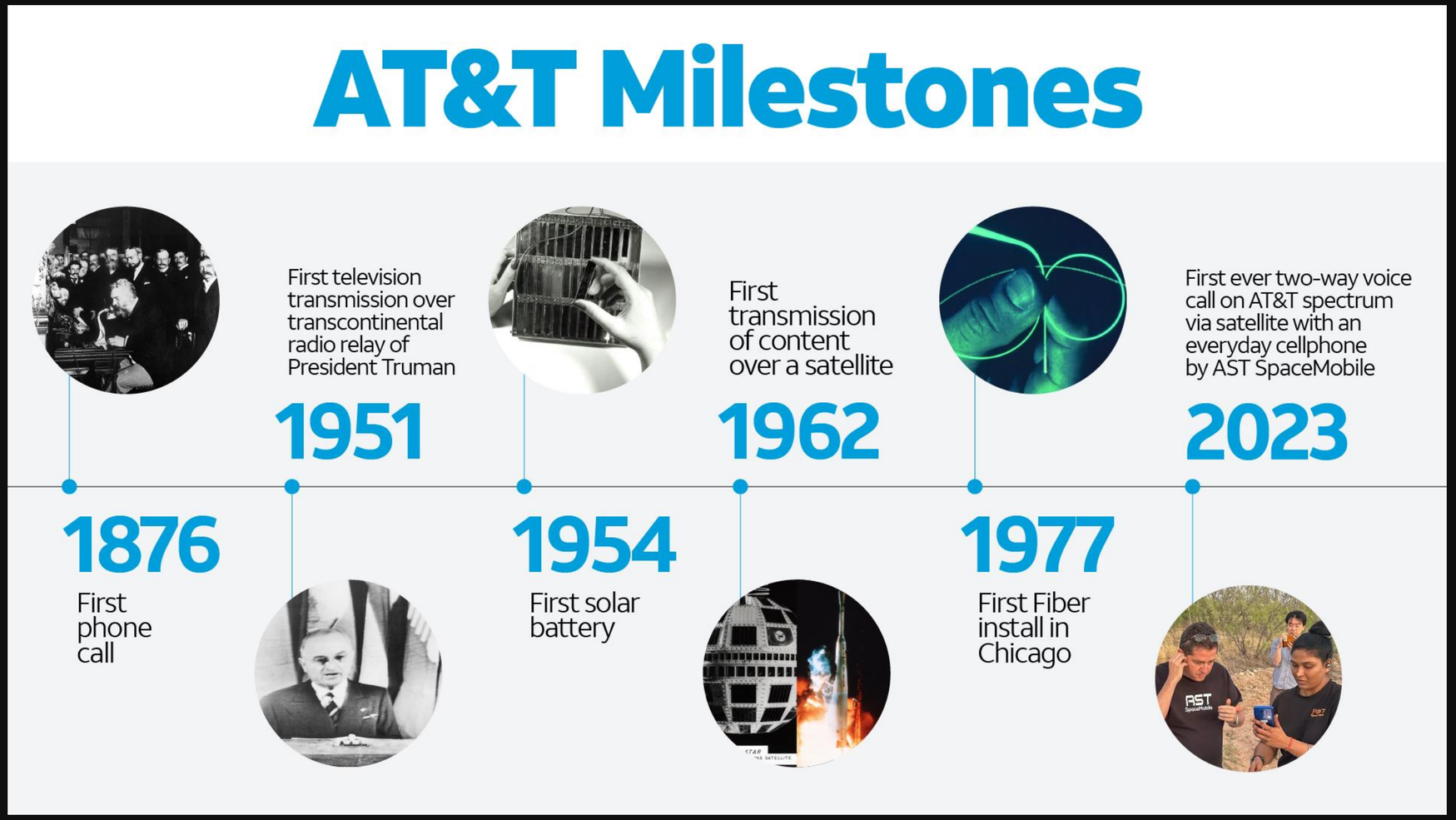
AT&T

Rakuten Mobile

Call made by AST Founder and CEO Abel Avellan calling Rakuten CEO and Founder Mickey Mikitani

History made:
First-ever space-based voice calls using everyday unmodified smartphones

Source: AT&T.



First ever LTE connection from Space at broadband speeds

- 

Timelines Overview

BW3 in-orbit operations roadmap and Commercial Satellite Launch

BW3 Launch Milestones

Commercial Constellation

T: September 10

- Launched Sept 10 on a SpaceX Falcon 9
- BW3 placed into orbit

Nov- June

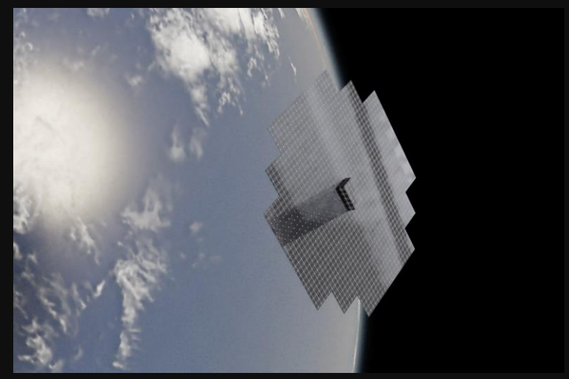
- Initial in-orbit testing
- Internal testing:
  -Software updates
- -voice+LTE
  -phased array calibration
  -Deploy QV antennas

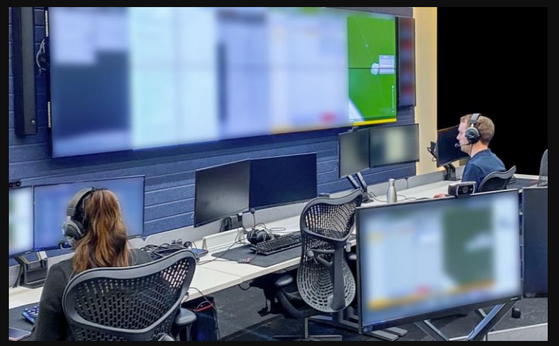
T+8 Months

- Cellular broadband direct-to-cell phone testing on standard handsets, in cooperation with participating MNOs on six continents
- Testing with our BW3 satellite to be conducted utilizing Nokia and Rakuten commercial MNO infrastructure

Q1 2024

- Launch first 5 commercial satellites
- Provide intermittent service
  - IoT
  - Intermittent Broadband for emergencies
- Launch more commercial satellites in 2024 and 2025





Industry-Leading Strategic Partners and Customers

Investors

Became Public Company ASTS on the NASDAQ to Date raised $725m

vodafone

#1 Mobile Network Operator (Outside China)

Rakuten

#1 e-Commerce Platform in Asia (Outside China)

AMERICAN TOWER®

#1 Global Cell Tower Company

SAMSUNG NEXT

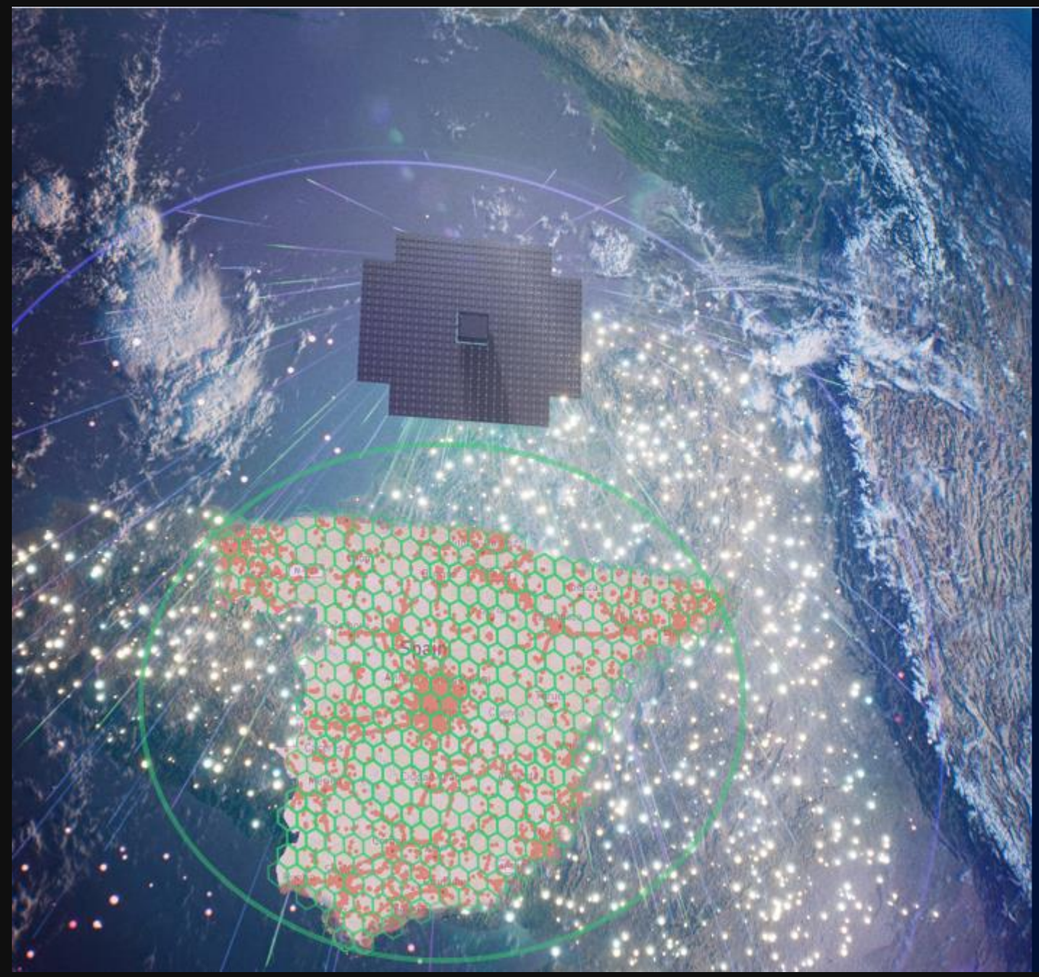
#1 Manufacturer of Mobile Phones

Source: Nasdaq, WCIS, Gartner and S&P Global.

Customers

vodafone
AT&T
Rakuten Mobile
Bell
اتصالات etisalat
orange™
Telefónica
XL axiata
smartfren.
MTN
Indosat ooredoo
Telstra
Globe
Smart
TELECOM
tigo
africell
LIBERTY LATIN AMERICA
yes telecom
uganda telecom

Sample AST SpaceMobile Coverage: Spain



Sample SpaceMobile Cells

- Satellite Field of View ~2800 km diameter
- ~1,100 cells of 24 km diameter to cover entire country
- MNO decides which cells (hexagons) are active and which cells are turned off

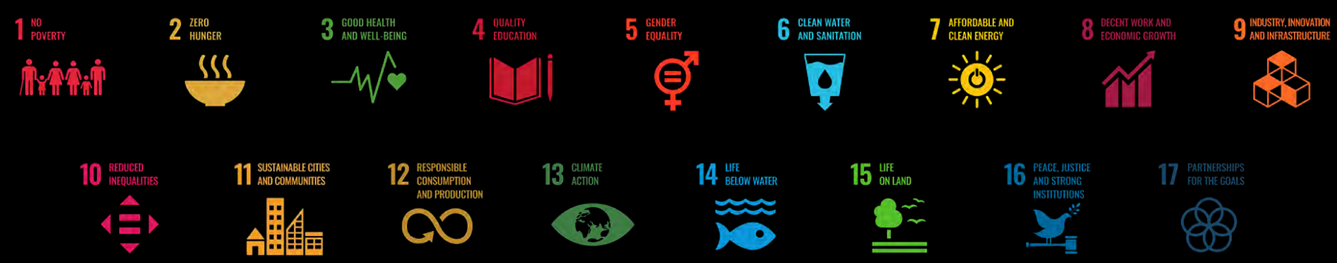
Satellite and mobile policy: opportunities

Social and Economic Benefits: the UN SDGs

In January 2020, before the COVID-19 outbreak had reached pandemic proportions, United Nations Secretary-General António Guterres launched an ambitious 'Decade of Action' to fulfil the promise of the 2030 Agenda for Sustainable Development.

Taking stock of mixed progress to date on the 17 Sustainable Development Goals agreed by world leaders in 2015, the Secretary-General called for accelerated action at all levels over the next ten years.

"We need to move together," he said, "leaving no one behind."



Source: GSMA October 2020 - https://www.gsma.com/newsroom/blog/mobiles-contribution-to-the-sdgs/

Social and Economic Benefits: the UN SDGs

- In 2015 the UN set the Sustainable Development Goals, which were intended to be achieved by 2030
- Progress has been made, but challenges remain - national governments and the wider international community now recognize that the world is not on track to deliver the 2030 Agenda for Sustainable Development
- We urgently need to extend mobile connectivity to those who remain unconnected
- The poorest and most vulnerable are disproportionately affected by remaining unconnected

THE FACTS

- An increase of 1 per cent in mobile broadband penetration yields a 0.15 per cent increase in GDP
- Mobile broadband appears to have a larger economic impact than fixed broadband: a 1 per cent increase in mobile broadband penetration yields a 0.15 per cent increase in GDP, versus a 0.08 per cent increase when fixed*

THE SOLUTION

- Embrace innovative communications technologies
- Align national government policy and regulatory frameworks to accelerate realization of the UN's connectivity goals

*Source: https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/FINAL_1d_18-00513_Broadband-and-Digital-Transformation-E.pdf

Future of Broadband and the Role of LEOs

Why LEO satellites

ast-science.com

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State of Broadband AC
(after covid))

COVID-19 PANDEMIC: BROADBAND OPPORTUNITIES AND CHALLENGES

- Accelerated the adoption of digital services, e-Gov, e-commerce, e-learning, e-medicine:

Source: 2022 Broadband Commission Report

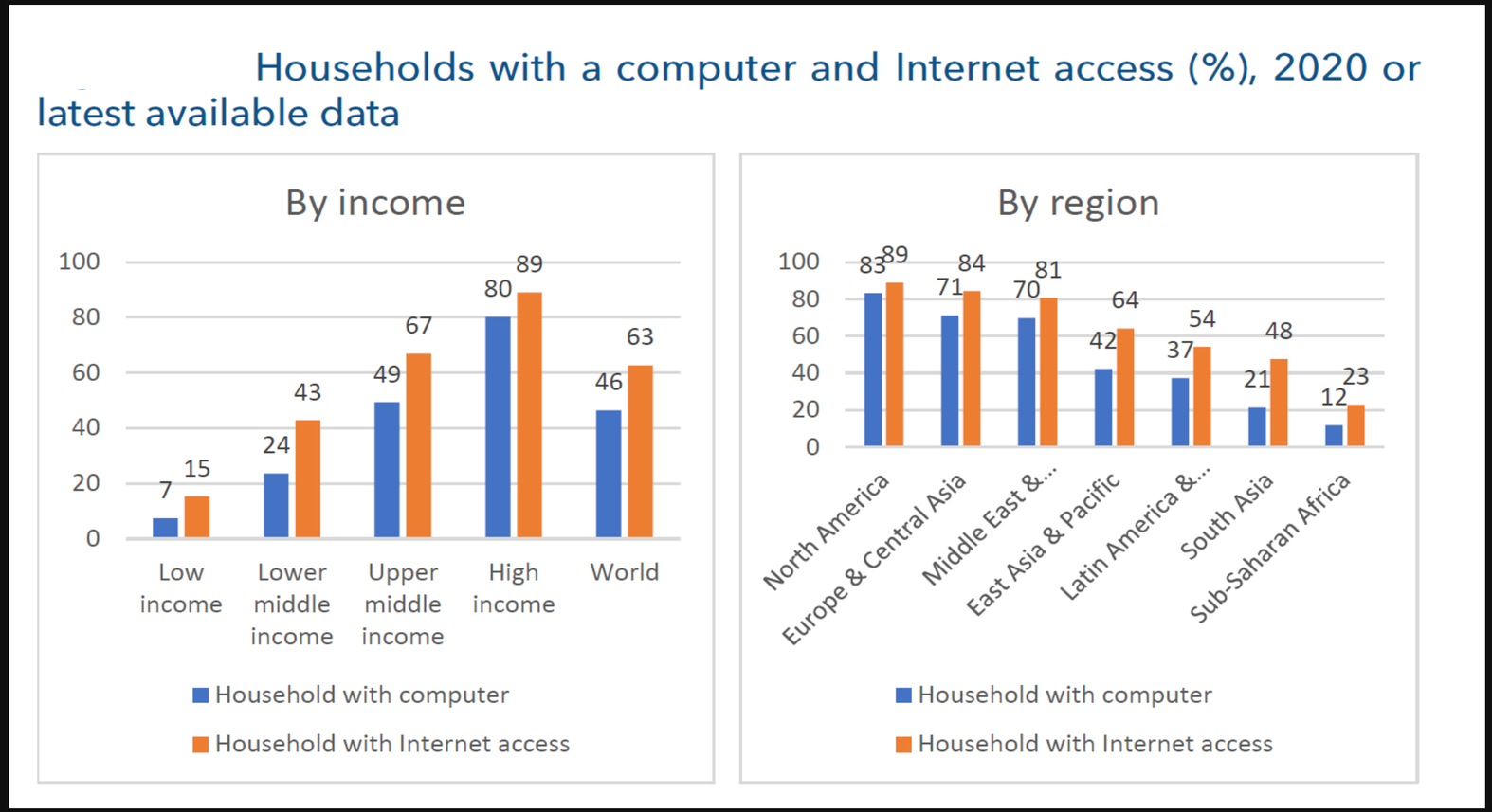
- Internet users grew by over 11% in 2020, internet use reaching 66% of the global population in 2022.
- Despite the surge in demand, networks withstood the explosion in data traffic during the pandemic,
- Demand growth illustrated internet access is a necessity (not a luxury)

- The pandemic magnified the consequences of the digital divide, with 2.7 billion people lacking broadband access:

- a ‘lost’ generation of learners who could not access e-learning
- Affordability of Broadband services worsened in 2021 due to a sharp drop in incomes, even though service charges continued to drop.

Global Digital Divide

- Low and Lower Middle Income countries are disadvantaged in terms of internet access and computer ownership
- Even in High Income countries the “Gap” is still significant



Connecting Rural Communities: What LEO satellite Broadband can Achieve

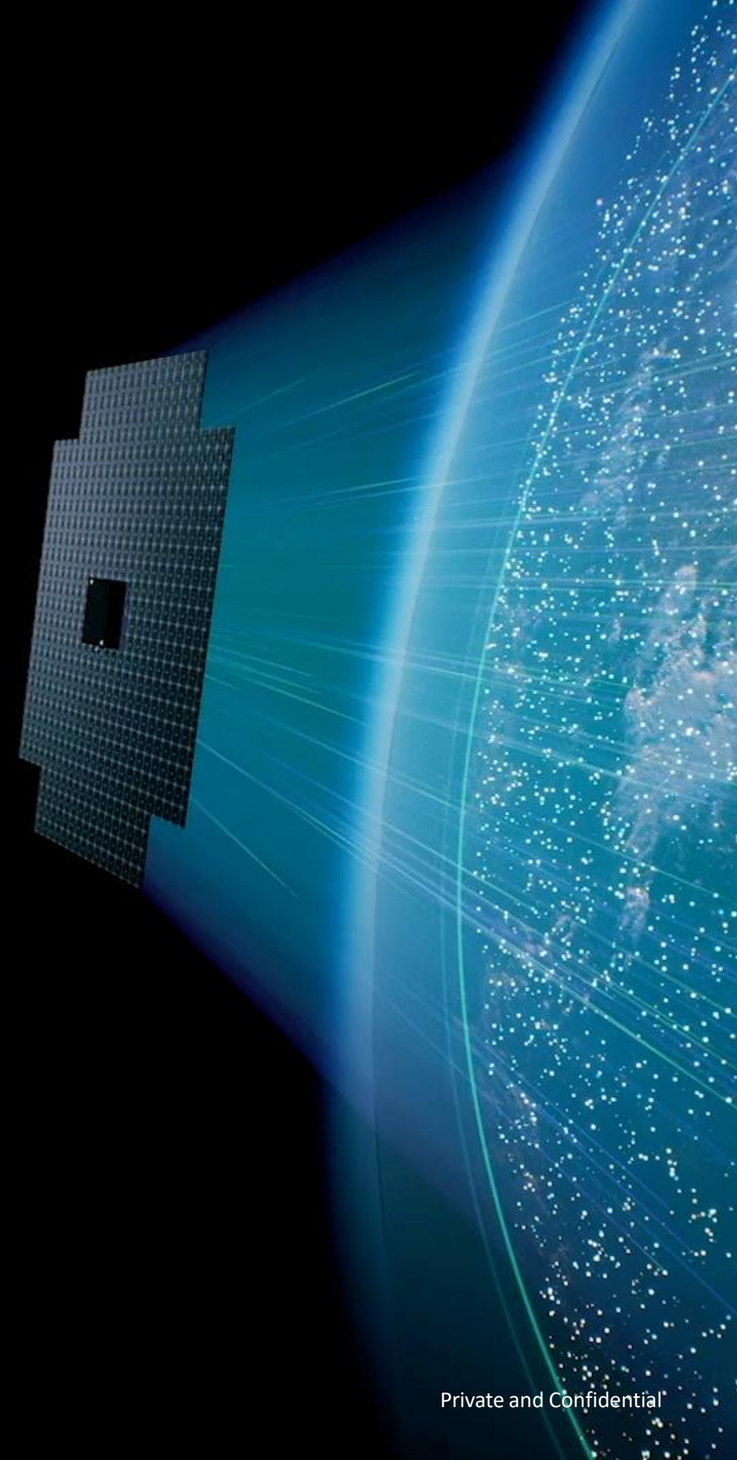
- **Affordable 2G and 4G LTE broadband wireless services nationwide**
- **Broadband access for e-learning , telehealth, Govt services**
- **Financial inclusion**
- **Remote working**
- **Reducing the digital divide**

Closing Remarks

LEOs offer opportunities for low latency broadband connectivities for unconnected communities, emergency responses, IoT, Comms on the move

Include LEOs Satellite Direct to Device technologies in your National Broadband connectivity Plans

Policy makers and Regulators will need to adopt new regulatory approaches to harvest the benefits of Satellite Direct to Device Technologies



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The information in this presentation and the oral statements made in connection therewith includes “forward-looking statements” that are not historical facts, and involve risks and uncertainties that could cause actual results of AST SpaceMobile to differ materially from those expected and projected. These forward-looking statements can be identified by the use of forward-looking terminology, including the words “believes,” “estimates,” “anticipates,” “expects,” “intends,” “plans,” “may,” “will,” “would,” “potential,” “projects,” “predicts,” “continue,” or “should,” or, in each case, their negative or other variations or comparable terminology.

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