

Wireless Innovation Forum Webinar

Beyond the Tower

Dennis Roberson and William Webb

23 July 2026



Introduction to the Wireless Innovation Forum

Standards Development Organization

- Trade-association model
- Non-profit 501(c)(6)

Mission

- Advancing technologies supporting the innovative utilization of spectrum and the development of wireless communications systems, including essential or critical communications systems.

Broad, Diverse, and Global Membership

- Component, subsystem, equipment vendors
- Communications service providers
- Research organizations
- Academic institutions
- Government users and regulators
- Ensuring wide representation of perspectives.

What We Do

- Translate regulatory rules into industry-supported working system specifications.
- Inform government regulators with technical reports
- Submit *technical* regulatory recommendations in response to proposed rules

Neutral, Consensus-Driven Forum

- All members have 1 equal vote
- Impartial environment
- Industry-aligned agreement

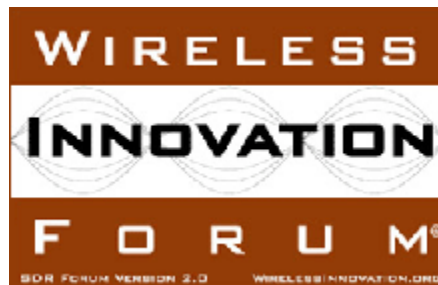
Contact Us

- www.wirelessinnovation.org
- John.Glossner@WirelessInnovation.org



Logistics

- Please enter questions into the Questions box
- Q&A will generally be held until after the presentation
- The slides and video will be posted on the WinnForum website after the conclusion of the webinar
- [Beyond the Tower](#) on Amazon



Our Speakers

Dennis Roberson



- **Founder, President, CEO of Roberson & Associates**
- 40 years industry experience
- Vice Provost for Research, and Research Professor in Computer Science & Law, at Illinois Institute of Technology
- Executive VP and CTO, Motorola
- Executive roles at IBM, DEC, AT&T, NCR
- Chair of External Advisory Board, SpectrumX
- Chairman of the Board, Marconi Society
- FCC TAC chair and member
- CSMAC member
- Board of several technology-based companies
- >50 publications
- BS in EE & physics, Washington State University
- MS EE, Stanford University

William Webb



- **CEO, Commciseive**
- Co-founder of Neul, leading to NB-IoT (4G and 5G standard for IoT connectivity)
- CEO of Weightless SIG, standards body developing a variant of Neul technology for unlicensed spectrum
- Director at Ofcom
- Multiple UK communications consultancies (hardware design, computer simulation, propagation modeling, spectrum management, and strategy)
- Strategic management at Motorola
- President of the Institution of Engineering & Technology
- SpectrumX Advisory Board
- 22 books, >100 papers, 18 patents
- Fellow of the RAE, IEEE, and IET
- PhD, University of Southampton

Beyond the Tower

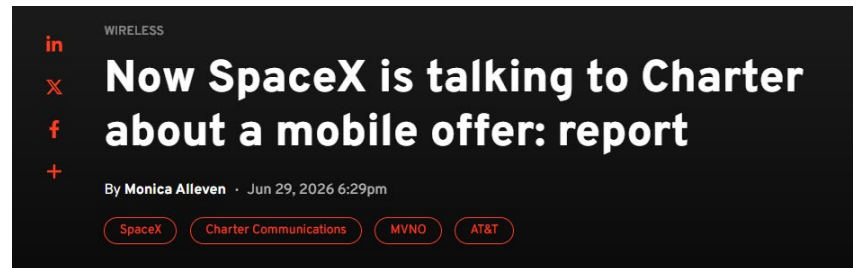
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The question we set out to answer

Can D2D satellite in any way replace terrestrial cellular?



BENZINGA

Could Elon Musk's SpaceX Buy T-Mobile? Analyst Sees Wireless Giant As 'Clear Choice'



CONNECTIVITY

Major US Carriers Band Together in Joint Venture to Encourage D2D Competition

By  Rachel Jewett

THURSDAY, MAY 14, 2026

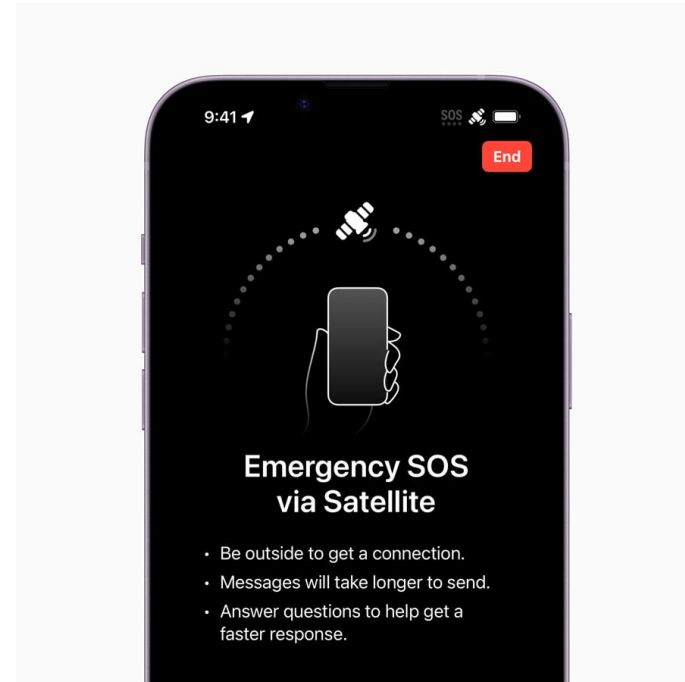
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Satellite Players and Analyst Respond

SpaceX execs seemed to take the news as a challenge, with President and COO Gwynne Shotwell posting "I guess Starlink Mobile is doing something right! It's David and Goliath (X3) all over again — I'm bettin' on David."

The current situation

- D2D already exists in the iPhone (courtesy of Apple's relationship with Globalstar) so around 1/4 of global consumers already have access to a D2D service (over half in the U.S.)
- SpaceX / Starlink partnering widely
 - T-Mobile relationship in the U.S. (adding to U.S. access)
- Amazon Leo signaling intent but struggling to get satellites launched
- AST has an alternative solution with larger satellites
 - Vodafone, AT&T and Verizon are key stakeholders



Historically related services have gone bankrupt

- Iridium failed badly but was repurposed out of bankruptcy mostly for military use and has recently been acquired by Rocket Lab
- OneWeb also rescued (by UK government) and subsequently acquired by Eutelsat.
- Globalstar rescued by Billionaire Jay Monroe, then by Apple, then bought by Amazon
- Beyond Globalstar, there have been many recent acquisitions and mergers in the satellite industry including:
 - Iridium by Rocket lab
 - Inmarsat by Viasat
 - Intelsat by SES
 - Lynk and Omnispace (supported by SES)
 - ...



Getting satellites into orbit is the first challenge

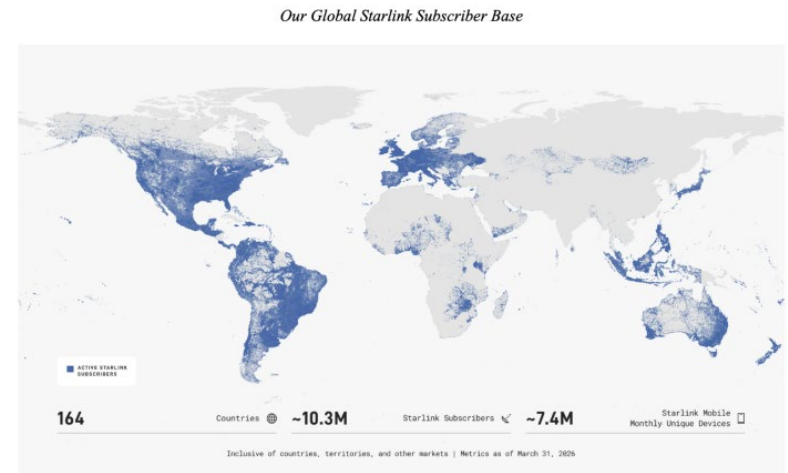
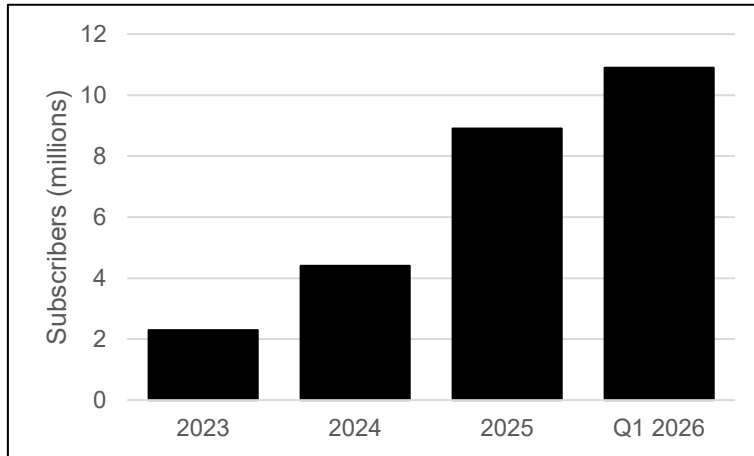
Country of Launch Provider	Number of Orbital Launches (2025)	Estimated Spacecraft Upmass (Metric Tonnes)	Share of Global Upmass (%)	Primary National Operators
United States	198	2,270.0	84.7%	SpaceX, United Launch Alliance, Firefly, Rocket Lab, Blue Origin
China	92	290.0	10.8%	CASC, CAS Space, LandSpace, Galactic Energy
Russia	17	80.0	3.0%	Roscosmos
Europe	8	25.0	0.9%	Arianespace, Isar Aerospace
Rest of World	14	14.4	0.6%	ISRO (India), JAXA (Japan)



An orbital Iron Curtain



Starlink fixed service is doing well albeit on falling ARPU



Average revenue per user fell to \$66 per month in Q1 2026, down from \$86 a year earlier and from \$99 in 2023.

D2D is clearly valuable for rural coverage

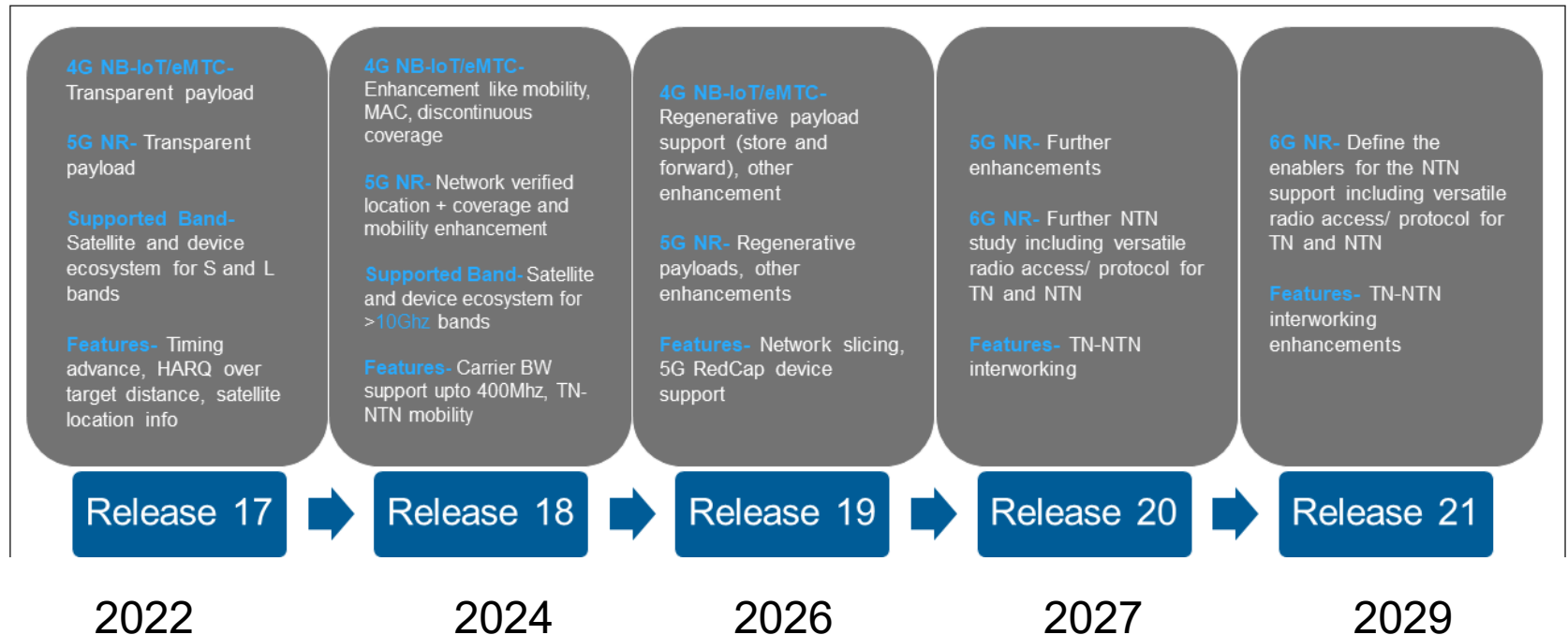
- A proposal by Three to erect a 35-meter mast at Cat Crag was rejected.
- The planning authority ruled that the "public benefits of improved mobile coverage did not outweigh the identified harm" to the World Heritage Site
- Might even allow uneconomic masts to be decommissioned



Coverage challenges exist globally

Metric	United Kingdom	United States	Canada	Australia
Population Coverage (4G/LTE)	>99%	>99%	99.4%	99.7%
Landmass Coverage (Best Carrier)	~96% (at least one MNO)	~60% (Verizon LTE)	<30%	~35% (Telstra)
Major Road Coverage	High (>95%)	High	~88%	Variable (High on coasts, low in interior)
Primary Policy Vehicle	Shared Rural Network (SRN)	5G Fund for Rural America	CRTC Broadband Fund	Mobile Black Spot Program (MBSP)
Key Topographic Challenge	National Parks	Vast Tribal Lands, National Parks & Mountain West	Arctic & Northern Forests	Remote Interior Desert

Standards are now in place but not in space



Costs of getting the initial constellation in orbit

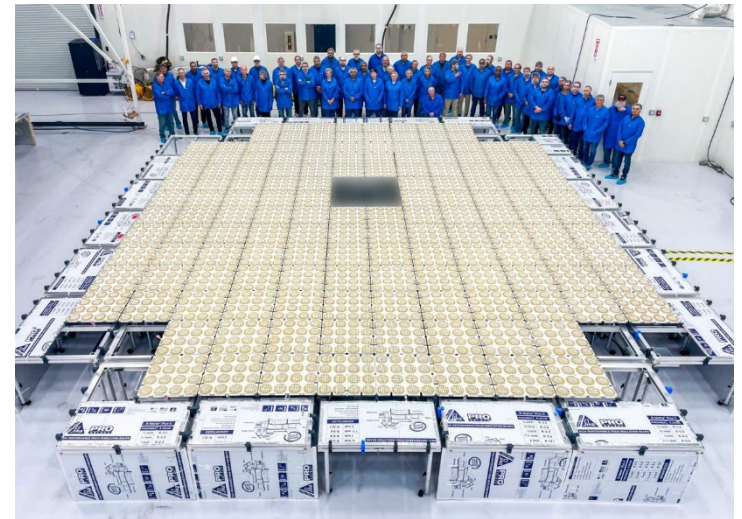
Cost Category	SpaceX Starlink (D2D)	Amazon Leo	AST SpaceMobile
Satellite Unit Cost	\$1.2M - \$2.0M	\$2M	\$21M - \$23M
Launch Cost (Per Sat)	<\$1M (Internal)	\$5M	(included in above)
Constellation Size (Target)	7,500+ (FCC authorization = 42,000)	3,200	~168 initially, up to 243
Est. Total Constellation CapEx	>\$15 Billion	~\$22 Billion	~\$3.5 Billion
Ground Segment Strategy	Proprietary, Massive Density	Proprietary, may leverage AWS sites	Partner MNO Co-location
Spectrum Cost	Revenue Share (MNO), acquisition \$20bn	Revenue Share (MNO)	Revenue Share (MNO)

Current fees

Service Provider	Partner Network	Pricing Model	Price Point	Target Segment	Status
Apple	Globalstar (soon Amazon Leo)	Hardware Subsidy	Free (included with device)	Mass Market (iPhone 14+)	Live
T-Mobile	Starlink	Tiered Bundle / Add-on	Free on Premium / ~\$15 Add-on	Premium & Mid-Tier	Live
Bullitt (Defunct)	Inmarsat / EchoStar	Standalone Subscription	\$4.99 - \$29.99 / mo.	Niche Rugged	Insolvent
Garmin	Iridium (soon Rocket Labs)	Standalone Subscription	~\$15 - \$65 / mo	Outdoor Enthusiast	Live (Legacy)
AT&T (predict)	AST SpaceMobile	Day Pass / Roaming + Subsc'n	~\$2 / day (Est.) / unknown	Occasional + Rural Users	Pre-Commercial

Business case (optimistic)

	SpaceX Starlink (D2D)	Amazon Leo	AST SpaceMobile
Capex \$bn			
Initial	15	22	3.5
Annual recurring	3	3.3	0.35
Capex 2025-2035	45	48	7
Revenues 2025-2035 \$bn			
Broadband	81.0	16.2	0.0
Mobile	16.5	9.3	9.9
Total (2025-2035)	97.5	25.5	9.9
Revenues less Capex \$bn	52.5	-22.9	2.9



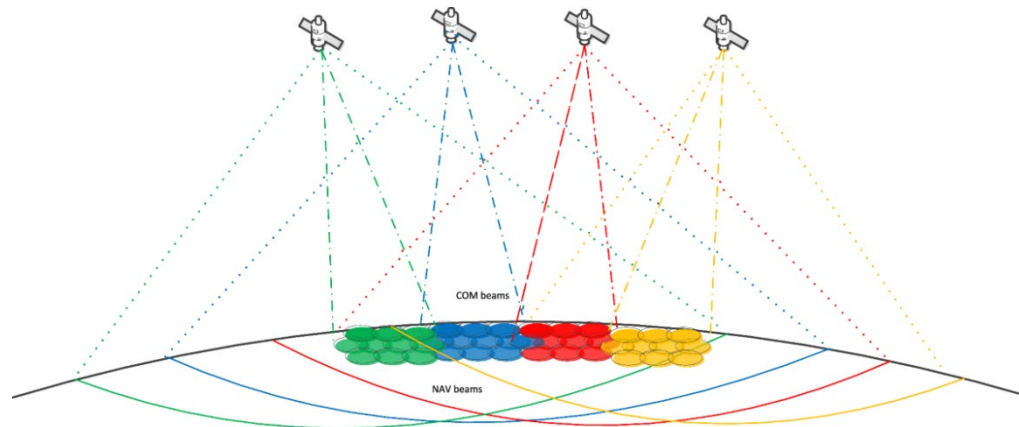
Spectrum: MSS or MS?

- Either
 1. SNOs will offer service directly to consumers, bypassing the MNOs (eg Apple), or
 2. SNOs will pair with MNOs. The MNOs retain the customer link and present a complete service package to the consumer (eg T-Mobile/Starlink in US)
- Recent evidence of MSS spectrum acquisition by SpaceX and AST suggests the SNOs would prefer to offer direct service
- But few have acquired enough spectrum globally to deliver a valuable service making an MNO route a necessary evil
 - Apple's service is limited to allowing iPhones to connect to emergency services, message friends and family, and request roadside assistance
- Expect a messy picture, with different options in different countries, at least for a few years



Satellite capacity is relatively very low

- A typical 3.5 GHz 5G mid-band deployment can deliver capacity densities between 270 and 3,000 Mbps/km²
- Analysis of the Starlink D2D architecture suggest that even with a fully deployed constellation of 42,000 satellites, the capacity density would be approximately 0.0065 Mbps/km²
- Nokia's techno-economic modeling indicates that D2D capacity density is more than 100 times lower than even a rural terrestrial 5G network (0.089 Mbps/km² for D2D vs. 10.9 Mbps/km² for rural 5G)
- T-Mobile President said said that based on May 2026 data, the use of T-Satellite is about 0.0002% of its total network usage



A simple capacity analysis

- In dense urban areas the capacity differential is approximately 1/10,000!

	Spectrum (MHz)	Efficiency (bits/s/Hz)	Cell size (km ²)	Capacity (Mbits/km ²)
Starlink	65	0.8	700	0.073565
Typical MNO	350	2	1	700

- There is little that can be done to address this
 - Smaller satellite cells are not viable because of antenna size and uplink imbalance
 - More spectrum can be found but only 2-5x
 - Spectrum efficiency limited by antennas, power and real world usage

Three scenarios

MNOs in the driving seat

- SNOs forced to use MS spectrum and hence partner with MNOs on their terms
- MNOs maintain consumer relationship and 50% of revenue from service
- Helps SNOs with limited budget since no need to acquire customers
- High probability (80%+)

SNOs win out

- SNOs gain MSS spectrum or other leverage, including buying MNOs
- Deliver a global service customer proposition and use MVNO arrangements locally
- Leverage 3GPP standards to use existing phone base
- Reasonable probability (60%+) in specialist segments but low (<10%) for general consumer

ISPs bypass MNOs

- ISPs use their in-home Wi-Fi presence to carry most traffic (e.g. Comcast / Charter)
- SNOs used elsewhere, bypassing MNOs
- Might build Wi-Fi or small-scale cellular networks in dense areas
- Probability <20% - satellite networks unlikely to have the capacity to handle outdoor offload

Predictions

What will happen

- Satellite D2D service will continue to be offered for the foreseeable future.
- Provision will become more competitive from SpaceX, Amazon Leo, AST and China (Guowang and Qianfan).
- Capabilities will improve to 2G/3G cellular level service

What won't happen

- D2D will not replace terrestrial networks.
- D2D will not be available indoors nor inside a vehicle, in tunnels, in trains...
- SNOs will not become the primary owner of the consumer relationship.
- D2D will not be a full backup for widespread terrestrial network failure

Uncertainties

- Whether there will be a positive business case for one or more of the SNOs.
- Whether the world will fragment into multiple national networks
- Whether national regulators will insist that MNOs deliver D2D capabilities in areas without terrestrial coverage
- Whether additional MSS spectrum will be made available

Can D2D in any way replace terrestrial cellular?

- **Definitely:** for deeply rural coverage delivering “2G” service levels
- **Possibly:** owning the customer if MVNO arrangements can be reached
- **Not at all:** replacing mobile networks. Perhaps purchasing them or increasing Wi-Fi off-load.

