

September 10, 2024

Sent Via E-mail: BEAD@NTIA.gov

To Whom It May Concern;

Our company is pleased to submit these comments on alternative technologies for delivering broadband to underserved and unserved user communities, either as a complement to or in lieu of traditional fiber. We recommend these alternatives be weighted equally in evaluations.

We recommend that any infrastructure deployed under BEAD consist of multi-modal technologies with symmetrical bandwidth, appropriate to the location and environmental factors of Pennsylvania. Our analysis has shown that, in many rural areas of Pennsylvania, it can be cost-prohibitive to deploy fiber due to various risk factors, including rugged terrain, protected lands, and water bodies. These risks impose significant construction, technical, and operational challenges for broadband deployments that rely solely on fiber. For instance, regions with rivers or environmentally sensitive areas face substantial difficulties in trenching or laying fiber underground, particularly when considering seasonal flooding or environmental impact.

In rural Pennsylvania, where mountainous regions and dense forests prevail, it is critical to explore alternative methods for broadband deployment that can handle the unique geographical challenges. These challenges are similar to those faced in other regions with difficult terrain, and they include both technical limitations and operational risks in maintaining fiber-based broadband infrastructures. For example, attempting to repair fiber cables in remote or difficult-to-access areas could be both dangerous and costly, especially during adverse weather conditions.

Given these factors, Pennsylvania must utilize a variety of alternate technologies to deploy middle-mile broadband across the state:

- 1. Use of Low Earth Orbiting Satellite (LEO) as an aggregate network gateway.**
- 2. Traditional microwave short-haul and long-haul frequencies 6-42GHz, including multi-Gbps E Band.**
- 3. Reliable Laser Optical Communications at speeds up to 10Gbps.**

Our analysis has shown that relying on any single technology poses significant risks to services. A multi-modal approach can leverage the best available technology at the right time, factoring in

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conditions and power constraints. For example, laser communications are particularly valuable, as they can provide up to 10Gbps throughput with low power consumption. This system can function in light haze or rain but may experience signal degradation in fog or inclement weather. In such instances, the system could automatically switch to another available technology if designed and installed correctly. The low-power nature of laser communication systems makes them particularly appealing in rural regions of Pennsylvania, where reliance on traditional power sources is costly. Additionally, laser systems are rated as eye-safe (ANSI Class 1 and Class 2) and can be used for ground-to-satellite, ground-to-air, and point-to-point connections. Utilizing multimodal technologies also ensures reliable, high-availability service that could attract third-party unaffiliated users, providing financial sustainability through subscription fees.

Finally, given the global demand for rural broadband deployment and the associated funding, we anticipate significant supply chain challenges in acquiring fiber optic cables, trenching equipment, fiber switching equipment, and telecommunications engineers. These factors could increase the costs and slow down fiber deployments under BEAD. We strongly encourage NTIA to consider these supply chain risks and adopt the following recommendations for Pennsylvania:

Recommendations for the Use of Alternate Technologies for NTIA BEAD Efforts

Alternative Technology #1: Low Earth Orbiting Satellite (e.g., Starlink) – Recommendation: Use in conjunction with other technologies.

While LEO satellites can provide the minimum standards for BEAD services to rural communities, they come with several challenges. The high costs associated with maintaining a satellite constellation, coupled with limited subscriber bases in sparsely populated areas, do not present a strong business case for long-term commercial sustainability. Moreover, LEO systems are vulnerable to jamming or interference in the event of geopolitical tensions. Thus, we recommend LEO services only be used as part of a broader solution and not as the sole option.

Alternative Technology #2: 5G OpenRAN – Recommendation: Allow for last-mile connectivity.

In many rural communities, 5G OpenRAN technology could provide wireless bandwidth to homes through broadband routers, significantly reducing the need for fiber installation to every



household. This approach would reduce costs, eliminate permitting delays, and ensure the rapid delivery of high-speed internet to rural Pennsylvania communities. Furthermore, it aligns with NTIA's goals to strengthen the domestic 5G supplier market.

Alternative Technology #3: Microwave Longhaul – Recommendation: Use in conjunction with other technologies.

Modern microwave longhaul systems are viable if supported appropriately. However, their power requirements may present challenges in remote areas. When coupled with low-power technologies such as laser communications, this technology can be supported at a lower cost. We recommend that microwave longhaul only be used if it can deliver BEAD service levels within acceptable cost ranges.

Alternative Technology #4: Low-power Laser Communications – Recommendation: Use in conjunction with other technologies.

Laser communications are rapidly advancing and can provide up to 10Gbps at distances of up to 12km. This technology offers significant potential for middle-mile deployment in Pennsylvania's rural areas, especially where fiber installation is not feasible. However, laser systems are susceptible to interference from weather conditions, so they should be deployed alongside other technologies like LEO satellites or microwave for redundancy.

Alternative Technology #5: Fiber optic cable in challenging environments – Recommendation: Restrict use unless deployed with minimal environmental impact.

In certain environmentally sensitive areas, such as rivers or protected lands, deploying fiber optic cable may not be practical. We recommend restricting the use of fiber in such areas unless it can be buried to a sufficient depth without impacting the environment or wildlife.

This letter represents our commitment to supporting Pennsylvania's broadband deployment initiatives under the BEAD program. We believe that a multi-modal approach is essential to overcoming the state's unique geographic and environmental challenges. Thank you for considering these recommendations.

Warm regards,



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