Fear of the Network to Nowhere

AirLandSeah is pleased to submit these comments on alternative technologies for delivering broadband to severed and underserved and unserved user communities as either a compliment and/or in lieu of traditional fiber to weighted equally in evaluations.

We recommend that any infrastructure deployed under BEAD consist of multi-modal with symmetrical bandwidth technologies appropriate to the location and climate of the deployed broadband. Our analysis has shown that in many locations, such as rural Alaska and Pennsylvania. For instance in Alaska, it is cost-prohibitive to deploy fiber in the ground due to a variety of risk factors including environmental, seismic, sensitive tribal lands, and melting tundra. These risks impose significant construction, technical, and operational risks for broadband deployments that rely solely on fiber. For example, in the winter, a majority of rivers in Alaska such as the Yukon (Williams, 2024) are completely iced over as early as October of each year. As a result, any breakage of fiber optic cable laid in the river becomes stranded until the thaw in late May of each year, making any attempt to repair too dangerous. Additionally, burying the cable in the river presents multiple technical challenges due to the rocky and boulder bottoms and threat to migrating salmon. While burying the cable will provide some protection from ice dams and basin scouring from ice breakups, it would have to be buried at a significant depth which is cost prohibitive to eliminate this risk totally.

These risks requires Alaska to utilize a variety of alternate technologies to deploy middle-mile broadband across most states:

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

Our analysis has shown that relying on any single technology proposes significant risk to services. Providing a multi-modal approach can leverage the best available technology at the right time for conditions and power constraints. For instance laser communications is particularly valuable in that it can provide up to 10Gbps throughput up to 22km with a power utilization of less than 50 watts. This system can work in light haze, rain, and light snow but the signal does fade out in heavy fog, smoke, and inclement weather. In these instances, an if designed and installed appropriately the traffic would automatically switch to the best available mode technology. It cannot be understated that the low-power nature of the laser communication system is a game changer in Alaska where these systems can be deployed using solar and microturbines for power, eliminating the need for traditional electrical services of costly fossil fuel generators. In addition laser system and also be utilized for ground-to-satellite, and ground-to-air and is rated as eye-safe (ANSI Class 1 and Class 2). Additionally, using multimodal technologies ensures a stable, high available service that would also attract third-party unaffiliated users to help fund and support operations and sustainment of the network through subscription charges.

Finally, based on the global acceleration of broadband deployments and the massive global funding for rural broadband, we are anticipating significant supply chain challenges in acquiring fiber optic cable, trenching equipment, fiber switching equipment, and telecommunications engineers. These factors will significantly disrupt, slow down, and increase costs for all fiber deployments under BEAD. We strongly encourage NTIA to consider the impact of this on future projects and adopt the following recommendations.

Recommendations for use of alternate technologies for NTIA BEAD effort.

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

While LEO can provide the minimum standard for BEAD services to rural communities, it comes with several challenges. The first challenge is cost. Based on our analysis, to complete a full shell of polar-orbiting satellites will require over 346 satellites at an estimated cost per year between $1.4B and $2.4B. These costs, when coupled with an extremely small global subscriber base in the arctic of 629K households (excluding Russia) does not indicate a robust business case for a commercial service. We believe that the long-term viability of this service is a significant concern and when coupled with existing "Fair Use" policies, users will be throttled when they hit a monthly cap. This throttling will significantly impact users as the service is widely deployed. This cap will be especially problematic for remote learning and telehealth applications. Finally, this service offers some significant risks in the event of a near-peer adversary engagement. LEO satellites are vulnerable to jamming and other threats that a near-peer adversary would likely deploy in a conflict. Once a local community becomes dependent on this service, it would be catastrophic if this service was lost and could result in loss of life due to critical safety information provided by this network to include emergency services, aviation weather information, and supply chain data. **Our recommendation is that LEO services only be used as part of a Broadband solution, not as the only solution due to these risks. We also recommend that detailed financial viability assessments be made for polar orbiting services to determine long-term viability of these services and community risks in the case of near-peer hostilities.**

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

In many rural communities that are densely packed, OpenRAN utilizing 5G can be utilized to provide wireless bandwidth directly to the community through a broadband router. This can provide up to 400mps download and 50gps upload speeds per household. Using this approach would significantly reduce the cost of installing fiber optic cabling to each household within a dense rural community as is typically found in Alaska. This would also eliminate the permitting delays, identification of existing infrastructure and future life cycle costs to maintain the fiber when cut. This approach also affords the delivery of cellular services to the local community with broadband delivered directly to end-user devices. This approach would also support NTIA's goals to improve the domestic 5G supplier market. We recommend that OpenRAN be the first consideration for last-mile connectivity when dealing with rural but densely located locations such as those found in Alaska.

Alternative Technology #3: Microwave Longhaul – Recommendation: Only use in conjunction with other technologies

Modern microwave long haul is a viable technology with the caveat that it can be deployed in a cost effective manner and supported. Based on our analysis, specific to Alaska, power is the major constraint of this technology. Due to the large power consumption required, it is challenging to power with solar and wind generation capabilities when used as the only technology. However, when coupled with other low-power options (such as laser communications), this technology could be supported for short periods by solar and wind-generated capabilities at a reasonable price point. **We recommend that microwave longhaul be allowed if it can be demonstrated the required BEAD service levels can be provided and it can be done so at the required price points for end-user services.**

Alternative Technology #4: Low-power laser communications – Recommendation: Only use in conjunction with other technologies

Laser communications technology is rapidly advancing and building off of developments in deploying this technology on large satellite constellations. The RTX company has over 12 years invested in developing this technology for dual-use applications and currently can sustain over 10gbps at up to 12km with plans to increase that to over 100gbps at the same range. Additionally, they have validated this system can support ground-to-air, and ground-to-space at the same bandwidths and latency equivalent to buried fiber. We believe that for Alaska, this technology offers significant opportunities to increase deployment speed and rapidly get a vast middle-mile infrastructure in place within the state. Our recommendation is to ensure this is coupled with other technologies to provide gap coverage in the event of really bad weather that impairs the laser communications. Our initial estimate is that this system can provide full bandwidth functionality approximately 90% of the time and switch over to other technologies such as LEO satellite and microwave backbone when required. **We recommend that laser communications be an allowed technology when coupled with viable plans to achieve the TRL and MRL requirements and when coupled with other technologies to ensure broadband availability levels.**

Alternative Technology #4: Fiber optic cable deployed in rivers that freeze over - Recommendation: restrict use unless buried to a sufficient depth and in a manner that does not impact spawning fish