ATS
ALASKA TRIBAL SPECTRUM

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Tyler Sachtleben
Office of Governor Mike Dunleavy
PO Box 110001
Juneau, AK 99811

October 31, 2021

Re: **Comments on Broadband Task Force Draft Report**

Dear Mr. Sachtleben,

The Alaska Tribal Spectrum (ATS) is a tribal nonprofit that manages 2.5 GHz spectrum for over 100 member Alaskan tribes. This ATS spectrum, along with other FCC awarded tribal 2.5 GHz spectrum, could be used to service wireless last mile networks for about 95% of the entire state. However, there is a license requirement that it needs to be built out to certain levels over the next 2 years lest it go back to the FCC and out to auction. The tribes need grant funding that allows for wireless last mile infrastructure buildouts using their 2.5 GHz spectrum to happen now to prevent the loss of this valuable resource. For many of our remote communities, the only viable way to meet this requirement, before the FCC clock runs out, is with a satellite middle mile.

The report specifying low latency (less than 100ms) as a requirement to determine service puts our remote communities at a fundamental disadvantage. The task force report describes satellite as a possible middle mile, but it also emphasizes that low latency solutions like fiber are the best and recommended choice. In other words, it implies fiber proposals are preferred because fiber has no significant latency. The problem is that fiber is not possible anytime soon for a large number of rural tribal areas that will continue to suffer without relief because of this latency requirement. Setting a mark at 100ms or less for latency does not allow for new high speed GEO satellites to provide large capacity for the bulk of streaming and background application updates that represent the majority of internet usage, to augment low latency solutions and reduce overall cost. This is a lower 48 bias that does not help to address the unique current needs of unserved rural unserved Alaskans. Higher latency GEO satellites in combination with LEO satellites can deliver a very satisfying and affordable service representing hundreds of GBits over Alaska, but GEOS are discouraged for these type of grant applications by the restrictive latency funding language.

Language that promotes the use of satellites to deliver broadband almost immediately to the unserved and underserved population in the state is helpful. Making recommendation language that boxes out GEO satellites due to latency restrictions or promotes fiber only is not helpful in Alaska.

If you live in an area that has good internet service or cell phone service now that you depend on, imagine a day, or a week, without it. Now, imagine many more years without it. That is the reality for over 60,000 rural Alaskans. There is no argument that if available, a fiber middle mile can be the perfect choice. It goes very fast and costs a lot, and if it can be funded, it is the best choice. But in areas that have no access to fiber now, a very good solution is a mix of new LEO or GEO satellite middle mile. Waiting for a perfect fiber solution to arrive will also cause many rural tribes to miss the window for the tribal FCC buildout requirement and they will lose their spectrum. We need not make perfect the enemy of good. A mix of GEO and LEO satellite can affordably stream 4K video, stream music, and play real time games. Also, a wireless last mile instead of fiber to the premises (FTTP), can provide abilities like walking around real time facetiming, village wide cell phone service, support for remote sensors for IoT devices, and making 911 calls in an emergency village wide. A FTTP solution cannot.

The report promotes last mile FTTP as the best last mile solution. This does a disservice to any tribe with 2.5 GHz spectrum. With FTTP, rather than a wireless last mile, the tribe will lose their 2.5 GHz spectrum and be locked into a single fiber provider. All tribal network choices will be lost.

Therefore, we are suggesting that the focus of the task force recommendations for rural Alaska should be to first build out wireless networks now. These networks should be standards based capable to support LTE 4G/ 5G service in the future. These networks should be supplied with fiber or microwave if readily available. If not, we suggest the report language recommend a mix of high and low latency satellites as a very good choice to deliver affordable broadband now to those areas. This will allow all tribes to maintain their 2.5 GHz license. That is the rural Alaska answer.

This is also the design of the Alaskan Tribal Network that Alaska Tribal Spectrum has proposed for federal grant funding with its member tribes. The reason is that it maintains 100% of tribal choice and can deliver affordable broadband everywhere in Alaska now. Because it is prohibitively expensive to bring fiber for many years to rural Alaska or ever, satellite is the only realistic answer to reach everyone in the near future. A satellite-based solution can be delivered at 10 times less cost than a fiber solution and be connected as soon as the last mile wireless network is constructed (upon delivery of the equipment- a week or two for a small village). This approach also allows the tribes to meet FCC buildout requirements and maintain control of their networks The tribes can earn revenue for use of the spectrum. Each tribe can choose to own the last mile equipment rather than relinquish control and ownership to profit based entities. For Alaska, satellites are key to tribal success and recommendation language that promotes satellite choices instead of restricting them, is essential. Recommending a satellite mix of GEO and lower latency MEO and LEO lets the tribes make sensible choices to meet their needs now while awaiting any possible future fiber connection.

Specifically, ATS suggests the following changes to the report language.

Starting on page 30 and ending on page 36 of the report **–** ***<u>suggested changes/additions are in bolded italics</u>*** ***<u>and underlined</u>*** Suggested deletions are in **~~bolded cross out text.~~**

A. Geosynchronous Satellites (GEO)

Geosynchronous satellites have historically provided middle-mile links to Alaska communities where terrestrial middle-mile solutions could not reach. Geosynchronous satellites serve Alaska from a fixed position in space. As the earth rotates, geosynchronous satellites maintain the same orbital position over the earth's surface at high altitude (a distance in the range of ~22, 000 miles). The satellite essentially serves as a bridge, linking what are called "earth stations" on the ground in remote communities to purpose-built gateways on the ground that are fed by fiber-optic cable(s), enabling connectivity to the global internet. The Seward, Alaska teleport facilityis an example of such a gateway, which connects satellites to fiber-optic networks operated by TelAlaska and Alaska Communications.

Current geosynchronous satellites that can serve Alaska have limited capacity at a very high cost, and because signals to and from geosynchronous satellites in high-earth orbit must traverse such significant distances, those connections are inherently very high latency, regardless of throughput capacity. Two-way video communications, and real- time applications such as gaming may not operate well over connections that are servedby geosynchronous satellite middle mile. ***New High Throughput GEO satellites like Aurora 4a from Pacific DataPort (launch Spring 2022) and others employ advanced technologies that can serve the needs of rural Alaska in areas where fiber or microwave is not available at a reasonable price point.***

Pros:

- Can serve locations that do not have access to terrestrial middle-mile infrastructure
- ***Up to 10 times less cost per subscriber to provide needed infrastructure than a fiber or microwave solution.***
- No permitting required, beyond what may be required for earth station/gateway construction

Cons:

- Limited throughput capacity as compared with other middle-mile technologies
- ***Current available satellite is*** highest cost per megabit ***for subscriber service.***
- Availability of leasable capacity is currently limited for Alaska
- Current satellites operate at an orbital plane that requires line-of-sight low on the horizon
- Inherent high latency makes real-time applications such as two-way video communication challenging to impossible
- Sunspot activity causes disruptions in service

B. Low-Earth Orbit Satellites (LEO)

LEO satellites operate at an altitude in the range of approximately 750 miles above the Earth's surface, making low-latency connections of 50ms or less possible. LEO satellites are not geosynchronous, meaning they do not operate from a fixed position, but are rather launched as part of a constellation of hundreds or even thousands of satellites that are constantly in motion, forming a grid above the earth that allows for multiple satellites to be in view from any single point on the ground once sufficient orbital density is achieved.

Several companies, most notably SpaceX Starlink, OneWeb, and Telesat, have either launched, or have announced plans to launch LEO satellite constellations that will serve Alaska.

As of September 1, 2021, OneWeb has launched 288 of its planned 648 satellites for its initial constellation—offering up to 375 Gbps of capacity over the Arctic, including Alaska. The company reports that it will achieve 24/7 coverage over Alaska by November 2021. OneWeb's gateway in Alaska is located at the Talkeetna, Alaska Teleport. OneWeb is primarily focused on providing middle-mile connectivity to serve local ISPs, large corporations, and government entities.

SpaceX Starlink, as of September 2021, has launched more than 1,700 LEO satellites, 1,657 of which are currently operational and 10 of which are polar orbiting. Unlike OneWeb, Starlink is primarily focused on providing end-user connectivity. But its robustnetwork is capable of providing high-capacity middle-mile connectivity for local ISPs andlarge corporate customers as well. Starlink is pioneering satellite-to-satellite laser communication to enable more efficient traffic routing and the need for fewer Earth gateways. Of the satellites that SpaceX has launched to-date, approximately 51 are capable of intersatellite communication.

Telesat, has announced plans to launch a global constellation of 298 LEO satellites that,by the 4th Quarter of 2024, will be capable of providing 320 Gbps of capacity over Alaska.

Pros:

- Higher capacity than most geosynchronous satellite solutions
- Low-latency solution that enables many real-time applications, including two-way video communication
- ***Available now.*** Can serve locations that do not have access to terrestrial middle-mileinfrastructure ***or may not have for a long time anywhere in Alaska.***
- No permitting required, beyond what may be required for earth station/gateway construction
- ***Up to 10 times less cost per subscriber to provide needed infrastructure than a fiber or microwave solution.***

Cons:

- Limited throughput capacity as compared with fiber; can only serve a limited setof users in an area, depending on population density
- ***Possibly*** higher projected ***subscriber*** costs than fiber and microwave middle-mile solutions
- New technology with more unknowns that proven legacy technologies
- ***May require mounting on a tower with other telecommunications equipment.*** Requires significant line of sight to sky, with no trees, mountains, or buildingsblocking the view

C. ***Mid-Earth Orbit Satellites (MEO)***

Mid-Earth Orbit (LEO) operate in an area between LEO and GEO and are close enough to have a latency of less than 150ms. That is a little over an eighth of a second – the minimum human reaction time, meaning it is unnoticeable and can support enterprise-grade low latency applications, including critical cloud and edge services,. Instead of using thousands of satellites like LEO which cover smaller areas, MEO at about 8000 km can provide high quality fast connections with just 6 satellites. SES mPower is planning the launch of polar orbit MEOs to extend their successful fleet of existing equatorial MEOs in 2024 and 2025 that will make hundreds of GBits of capacity available everywhere in Alaska.

Pros:

- ***Proven technology***
- ***High capacity 100s of Gbits will be available over all of Alaska.***
- ***Low-latency <150ms solution that enables many real-time applications, including two-way video communication***
- ***Can serve locations that do not have access to terrestrial middle-mile infrastructure anywhere in Alaska.***
- ***No permitting required, beyond what may be required for earth station/gateway construction***
- ***Up to 10 times less cost per subscriber to provide needed infrastructure than a fiber or microwave solution.***

Cons:

- ***Available in 2024 to 2025 in Alaska.***

Summary: Middle-Mile Technologies

Fiber-optic cables are considered by the task force to be the "gold standard" middle-mile solution. As such, it should be deployed wherever feasible. Fiber offers unparalleled capacity and is scalable and upgradable to meet future demands. It also provides the lowest-latency connections over long distances, is the most reliable, and has the lowest operational and maintenance costs over time.

Microwave wireless is also a solid option where the costs of fiber-optic deployment are prohibitive. It can be used to extend networks beyond the reach of deployed fiber. Satellite-based solutions ***that can provide high speed service with a mix of LEO or MEO, and GEO are solid options for rural Alaska*** where lack of funding or technical feasibility limits the reach of fiber or microwave solutions. Satellite middle-mile solutions continue to evolve, and new technologies—particularly ***a mix of High Throughput GEOs,*** LEOs, ***MEOs***—may offer a competitive option to microwave wireless once ***LEO, and MEO constellations and new High Throughput GEOs*** are fully operational over Alaska.

Last-Mile Technologies

Last-mile technologies are deployed by local internet service providers (ISPs) to serve individual homes and businesses. As with middle-mile technologies, each type of last-mile technology offers benefits and drawbacks, and the context of the deployment will determine which solution is best in each area.

Last-mile services consist primarily of four service delivery technologies: **fiber-to-the-premises (FTTP)**, **digital subscriber line (DSL)**, **coaxial cable,** and **fixed wireless**.

Additionally, at least one **low-earth orbit (LEO) satellite** operator—SpaceX Starlink—expects to begin providing last-mile services directly to end-user customers in Alaska in 2022.

A. Fiber-to-the-Premises (FTTP)

In much the same way that fiber-optic cables offer significant advantages as a middle-mile solution, fiber that is deployed *within* communities to individual homes and businesses (i.e., "premises") also offers the unparalleled benefits of very high-speed connections (exceeding 1 Gbps) and reliability. However, this assumes that the local FTTP network is connected to the global internet via a reliable, high-capacity middle-mile solution. FTTP networks are either deployed aerially by attaching fiber-optic cablesto power or telephone poles or deployed underground, either through installed conduitor in micro-trenches that are created by a machine that is purpose-built for burying fiber.

Many telephone companies across the United States are gradually replacing their legacy copper telephone lines with fiber-optic cables, enabling FTTP as an internet service option for their customers. FTTP installations require the installation of a specialized modem within the customer's premises. A battery backup is typically required to keep the modem online during a power failure—an important consideration to ensure accessto 911 emergency services remains available.

Pros:

- Offers the highest capacity of any last-mile solution
- Offers symmetrical speeds (downstream/upstream) that can exceed 1 Gbps, enabling better real-time application performance, including high-definition two-way video communication for healthcare and education applications
- The most "future-proof" technology that is scalable/upgradeable over time; 30+ year operational lifespan
- Extreme reliability and network up-time
- Lowest overall maintenance cost
- Can be deployed incrementally, starting with fiber-to-the-node in a given neighborhood and then eventually all the way to each premises.

Cons:

- Except in the case of entirely new builds, requires "brownfield" deployment to overbuild legacy copper infrastructure, which can be costly
- Requires battery backup systems at the customer premises to ensure the abilityto dial 911 and reach emergency services in case of a power outage (legacy copper networks were powered by the lines themselves; no additional power source was required)
- ***FTTP installations do not meet buildout requirements for tribal 2.5 GHz. Tribes***

will lose this valuable asset.

- ***FTTP may lock in only one provider choice.***
- ***FTTP limits service to the home or business. It is not able to provide wireless community wide coverage.***
- ***FTTP has a much higher installation cost than fixed wireless solutions.***

B. Digital Subscriber Line (DSL)

DSL is a family of technologies used to transmit data over legacy copper telephone lines. DSL is usually asymmetric, meaning that download speeds are usually significantly higher than upload speeds. DSL usually requires the installation of a modem in the customer's premises, which communicates with another piece of equipment called a digital subscriber line access multiplexer (DSLAM), typically located in the ISP's telephone exchange facility.

DSL service performance degrades as the distance between the customer's modem and the DSLAM increases, extending as much as 12,000 to 18,000 line-feet away before the service becomes unusable. With significant upgrades to copper plant and replacement of legacy systems, downstream speeds can reach as high as 200 Mbps over distances of about 1,000 line-feet using "bonding" technology that allows multiple copper pairs to be bonded together to achieve higher speeds. Upstream speeds are generally limited to no more than 20 Mbps. The potential to upgrade copper plant to provide higher speeds must be measured against the long-term, higher capabilities of fiber last mile.

Pros:

- Widely deployed today over legacy copper telephone lines; can be good interim technology until fiber-optic technology is deployed
- Bonding technology can be employed to increase copper's efficiency
- Can deliver speeds of up to 200 Mbps if copper lines are maintained and the distance between the customer and the DSLAM is shortened

Cons:

- Limited speeds in both directions, with upload speeds extremely limited
- Can be very unreliable if copper lines have not been adequately maintained over time
- ***DSL limits service to the home. It is not able to provide wireless community wide coverage.***
- ***DSL installations do not meet buildout requirements for tribal 2.5 GHz. Tribes will lose this valuable asset.***

C. Coaxial Cable

Coaxial cable was first deployed by cable television operators as a means of delivering television services to customer homes and businesses in the 1980s and 1990s. Cable television operators gradually entered the residential broadband business in the early 2000s as demand for internet services increased.

Coaxial cables consist of a copper wire core, wrapped in dielectric insulation and an outer metal sheath, and followed by a plastic outer jacket for protection. As in FTTP andDSL installations, a modem is required in the customer premises to connect to the cable company's network.

Cable operators have gradually upgraded their equipment to be able to deliver faster and faster speeds to end-users. Typical cable installations offer speeds in excess of 300 Mbps downstream and greater than 100 Mbps upstream. But the latest technology under ideal conditions can now achieve gigabit speeds in each direction. As with other last-mile technologies, coaxial cable networks are limited by the capacity delivered to a community by middle-mile networks. Local coaxial cable networks are also vulnerable tocongestion and service degradation if shared network infrastructure in the community is oversubscribed. Coaxial cable deployments are most economically viable in communities where homes and businesses are densely located.

Pros:

- Widely deployed today in areas where the home and business structure densityis high
- Can deliver fast downstream speeds of up to 1 Gbps in ideal conditions; 300 Mbps to 400 Mbps under typical conditions

Cons:

- Vulnerable to network congestion when shared network infrastructure is oversubscribed
- Deployments are economically viable only in areas where structure density is high; not a solution for rural areas where homes and businesses are spread far apart
- ***Cable installations do not meet buildout requirements for tribal 2.5 GHz. Tribes will lose this valuable asset.***

D. Fixed Wireless

Fixed Wireless is a generic term that refers to a family of wireless technologies that can deliver last-mile broadband service to homes and businesses where it is impractical or too costly to extend wireline services like FTTP, DSL, or coaxial cable.

As the name implies, a fixed wireless installation is one in which the transmitting and receiving equipment is fixed in position. Fixed wireless services can be deployed over licensed or unlicensed spectrum, and usually involve the installation of an antenna or dish upon the customer's roof, ideally in a location that gives it line-of-sight to the nearest tower.

Speeds delivered over fixed wireless can vary greatly and are dependent upon a varietyof factors, including the spectrum being used, the distance between the customer and the tower and whether line-of-sight between the antenna and tower is possible.
Inclement weather can also have a negative effect upon the service and icing of equipment is of particular concern in Alaska.

Pros:

- Can be deployed to deliver new service or replace aging copper infrastructure ata much lower cost than wireline technologies

- ***Can be rapidly deployed in a rural village – 0ne to two weeks once equipment is delivered.***
- ***Can be easily coupled with any available middle mile – be it fiber, microwave or any satellite for immediate service anywhere in Alaska.***
- Can deliver speeds of up to 1 Gbps under ideal conditions
- Deployment time is typically much quicker than other last-mile solutions
- ***Supports the FCC buildout requirements for licensed 2.5 GHz tribal spectrum with almost statewide coverage. The tribes can maintain spectrum ownership and revenue benefits.***
- ***The network can support LTE and 4G/5G network mobility solutions using 2.5GHz licensed spectrum.***

Cons:

- Actual speeds and service reliability are dependent upon a variety of factors, including the type of spectrum being utilized (licensed or unlicensed), distance between the customer and tower, whether line-of-sight to the tower is achievable, and weather conditions
- Deployments using unlicensed spectrum may experience interference
- Licensed spectrum requires acquisition from the FCC or via a lease from an existing license holder

E. Low-Earth Orbit Satellites (LEO)

Soon, LEO satellite solutions that offer service directly to homes and businesses may also be a viable alternative as companies like SpaceX Starlink, OneWeb, and Telsat bringtheir systems into commercial operation.

More information on the pros and cons of this technology can be found in the previoussection on middle-mile technology.

Summary: Last-Mile Technologies

~~***As with middle-mile technologies,***~~ Fiber-to-the-premises is the ideal solution for last-mile service delivery ***for stationary home or business service*** where feasible and practical, given its ability to deliver very fast, reliable service that is scalable and upgradable as technology improves and as the demand for greater bandwidth increases over time. ***For community wide deployment of up to Gigabit speeds, a fixed wireless solution offers the advantage of delivery outside the home or business because you cannot put fiber in your pocket and walk about.*** Telephone companies will likely shift away from DSL service that is provided over legacy twisted-pair copper as maintenance and upgrade costs make the deployment of other solutions, such as FTTP or fixed wireless service, more sensible as a means of delivering higher speeds. Coaxial cable remains a fast, reliable solution for high-speed connectivity in densely populated communities.

It is important for policymakers to keep in mind that any terrestrial last-mile solution will always be limited by the middle-mile connectivity that serves it—so an equitable focus on upgrading and extending last-mile AND middle-mile technologies is important,particularly in a state like Alaska.

<u>For Alaskan tribal communities, a fiber middle mile combined with a fixed wireless last mile offers the best of both worlds – high speed and community wide coverage that can support gigabit speeds over an LTE 4G/5G network. It is a future proofed solution that also enables tribes who have been granted the use of 2.5 spectrum to meet the buildout requirements to maintain long term ownership and control of their digital destiny. It opens up many additional opportunities and future choices for the tribes. A FTTP only solution does not.</u>

Sincerely,

Alaska Tribal Spectrum Management Board

ATS

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