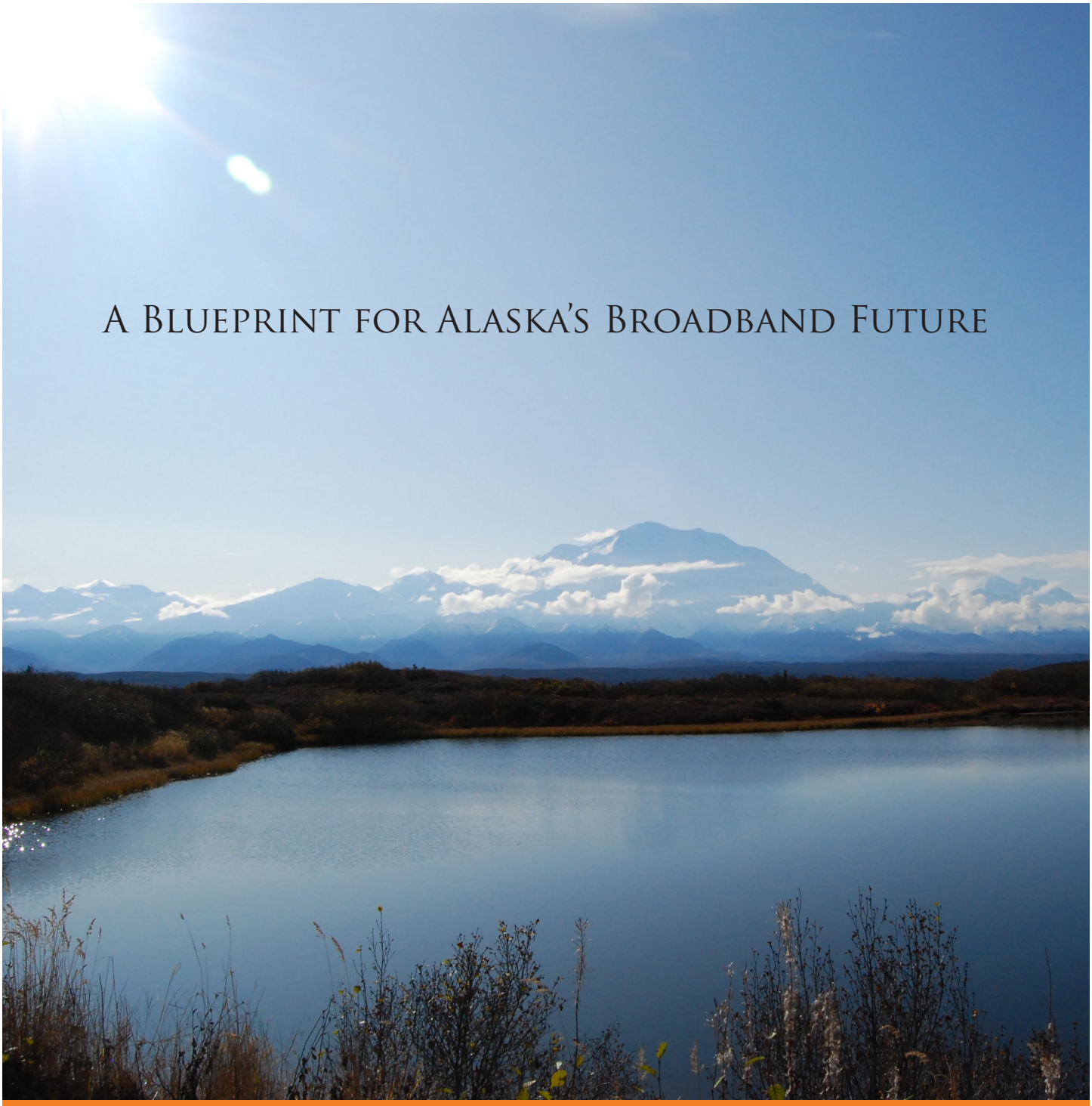
A Blueprint for Alaska's Broadband Future



A Report from the Statewide Broadband Task Force

August 2013

Table of Contents

Preface 4
Introduction 5
The Statewide Broadband Taskforce 7
- Goals 8
- Guiding Principles 9
- Implementation Practices 10

Alaska's Challenge: The Need for Better Broadband 11
- Economic Opportunity 14
- Facts About Broadband and Jobs 16
- Alaska's Tech Community 17
- The Transformation of Education 18
- Libraries in the Digital Age 21
- Health Care and Telemedicine 22
- The Public Safety Network 23
- Broadband and the Arctic 24

Alaska's Broadband Infrastructure 25
- Terrestrial Options to Connect Alaska Communities 26
- The Satellite Option 27
- Mobile Broadband 28

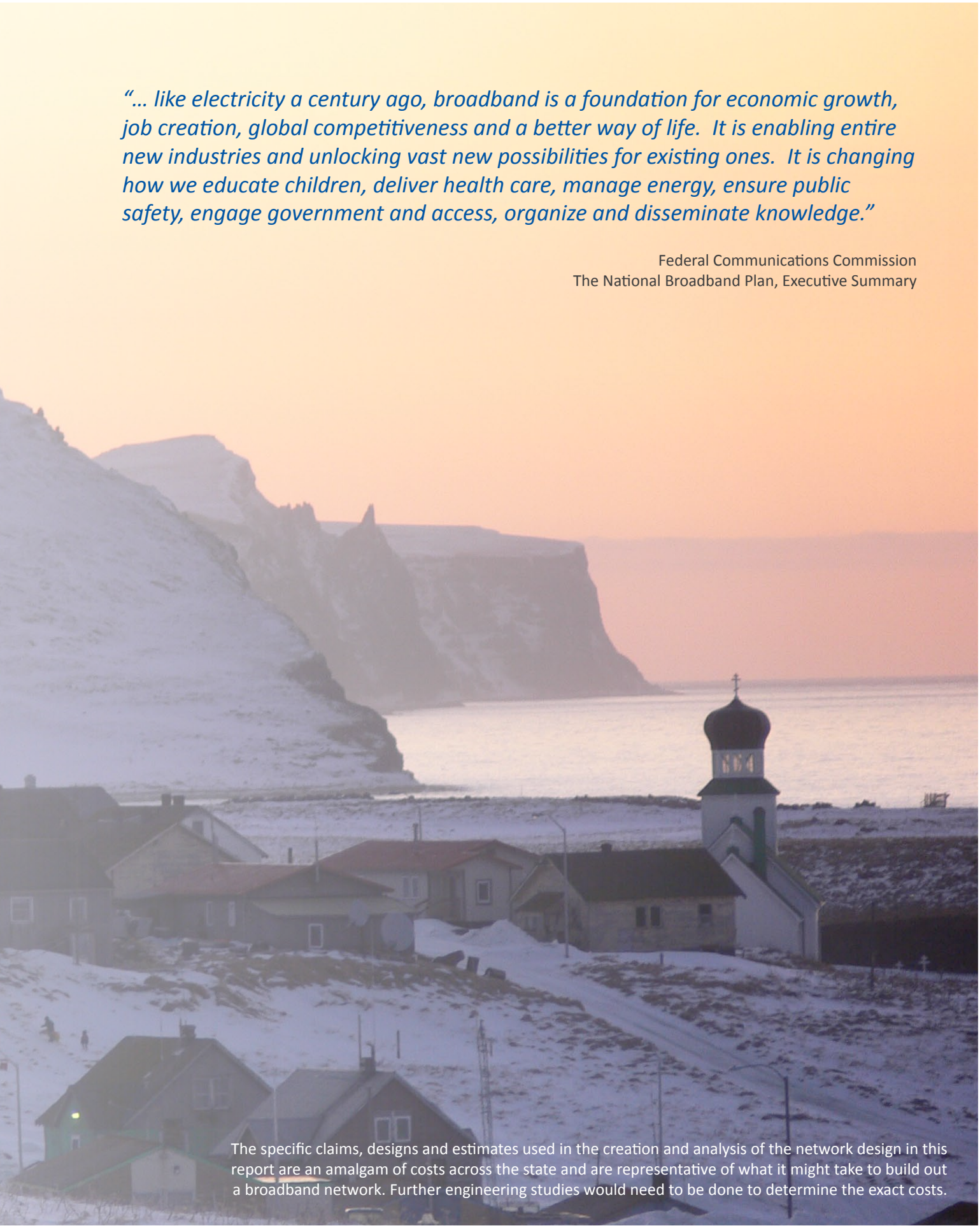
Recommendations 29
- General Recommendations 29
- Jobs Recommendations 31
- Education Recommendations 31
- Public Safety Recommendations 31

What Will It Cost? 32
- Example: Delivering High Speed to Hydaburg 33
- Example: Delivering High Speed to Unalaska 34
- Example: Delivering High Speed to the Pribilof Islands 35
- Example: Delivering High Speed to Point Hope 36
- Federal Universal Service Funding 37

How Do We Pay for It? Funding Options 38
Next Steps 40
Conclusion 40
Appendix A: Glossary of Terms 44
Appendix B: Broadband Fact Sheet 48
Appendix C: Broadband Presentation to the Alaska Broadband Task Force 50
Appendix D: Alaskan Communities With Internet Connectivity 52
Appendix E: Technology Adoption Rates for Alaska and Other States 57
Appendix F: Broadband Check List for Funders 58
Appendix G: Southwest Alaska Municipal Conference Case Study 59
Appendix H: Toward Universal Broadband in Rural Alaska 65
Appendix I: Literature Review 71
Bibliography 85

"… like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life. It is enabling entire new industries and unlocking vast new possibilities for existing ones. It is changing how we educate children, deliver health care, manage energy, ensure public safety, engage government and access, organize and disseminate knowledge."

Federal Communications Commission
The National Broadband Plan, Executive Summary



The specific claims, designs and estimates used in the creation and analysis of the network design in this report are an amalgam of costs across the state and are representative of what it might take to build out a broadband network. Further engineering studies would need to be done to determine the exact costs.

Preface

We no longer need to debate the benefits and role that broadband plays in the economy. The use of broadband services is prevalent in nearly all that we do from trade, commerce, education, and health care, to finance, government services, knowledge transfer, social networking, or simply entertainment. Technology, the Internet, and connectedness are part of our daily lives. This is as true for someone living in Seattle, Melbourne, or Stockholm as it is for someone living in Bethel, Point Hope, or Fort Yukon. Fast broadband speeds are a necessity to conduct commerce, engage with the government, and to educate our children.

Planning for Alaska's broadband future is imperative because the state lags in adequate statewide infrastructure. In fact, a December 2012 "State Broadband Index" developed by TechNet, an advocacy group comprised of innovators and technology leaders, ranks Alaska 49th of all 50 states in broadband adoption, network quality, and economic structure.[1]

A second snapshot of the nation's technological health, published in December 2012 by the Information Technology & Innovation Foundation and called the "2012 State New Economy Index," benchmarked economic transformation in all 50 states by asking one simple question: To what degree does the structure of state economies match the ideal structure of the New Economy?[2] The research measured five indicators: knowledge jobs, globalization, economic dynamism, the digital economy, and the capacity to innovate. Alaska ranked 28th of all 50 states.

This plan is a blueprint toward merging the State of Alaska into the already technologically robust 21st century economy. The plan offers creative and smart solutions to providing high-speed broadband and recognizes the state's commitment to digital learning, its responsibility to provide educational opportunity to Alaskans, the need for enhanced telemedicine delivery, the commitment to job creation, interest in natural resource development, and the need to provide response capabilities in the Arctic.

This plan offers 15 recommendations with funding options for achieving a new level of broadband service and concepts that should be addressed by both the State of Alaska and private industry. In short, the plan addresses middle mile (the connections between your broadband service provider and the Internet) and last mile infrastructure development (the broadband connection between your home or wireless device and your broadband service provider) to:

- Encourage the development of businesses related to information technology, one of the fastest-growing segments of the U.S. economy.
- Enable hospitals and clinics to make better use of telemedicine.
- Provide Alaskans with greater access to education through distance learning.
- Make Alaska more attractive to technology-driven businesses and corporations.
- Enhance public safety and emergency response systems.



Introduction



The Federal Communications Commission (FCC) has recognized that the transition from traditional telephony to broadband is underway and anticipates that broadband infrastructure will be the core delivery system for all forms of communication by 2020. In setting the new standards for broadband deployment and adoption throughout the country, the FCC has established a goal for download/upload speeds. The FCC has set the minimum performance expectation at 4 megabits per second (4 Mbps) download and 1 megabit per second (1 Mbps) upload and expects this to increase. The National Broadband Plan established a national goal for 100 million U.S. homes to have affordable access to actual download speeds of at least 100 Mbps and upload speeds of at least 50 Mbps by 2020, which is one of the key reasons why the Task Force chose 100 Mbps both download and upload as the goal for Alaska.[3] With that as the standard, the FCC says:

- Alaska ranks at the bottom in the percentage of households with access to broadband at 100 Mbps.[4]
- At even slower speeds of 200 Kbps, an FCC report issued in March 2011 noted that Alaska's percentage of residential broadband connections was at 87.1 percent, which was lower than comparable percentages in 41 out of 56 states/territories/districts.[5]

Some 21,000 households in Alaska currently are not served by broadband, and more than half the nation's anchor institutions (hospitals, schools, libraries, municipal or borough governments, etc.) with insufficient broadband capabilities are in Alaska.[6] So what would the opportunity to access greater Internet speeds produce? Economic impact projections based on most recent demographic and employment numbers from the 2011 Census show that a 1 percentage increase in broadband adoption could result in growing the Alaska economy by $67.7 million. Other benefits would include:

- 1,890 jobs saved or created[7]
- $49,184,413 in direct annual income growth[8]
- $221,743 in average annual health care costs saved[9]
- $2,536,553 in average annual mileage costs saved[10]
- 1,256,220 in average annual hours saved[11]
- $15,715,316 in annual value of hours saved[12]
- 3,276,906 in average annual pounds of CO2 emissions cut[13]
- $19,933 in average annual value saved by carbon offsets[14]

In a study commissioned by the Task Force, the University of Alaska, Anchorage's Institute of Social and Economic Research (ISER) found that broadband infrastructure appears to reduce costs, increase market access, and lead to job creation and growth in total employment.[15]

ISER looked at studies that examined the impact on sectors found in Alaska and said:

- Broadband can contribute to employment growth both as a result of infrastructure construction and spillover effects on the rest of the economy, particularly in industry sectors with high transaction costs such as financial services, education, and health care.
- Broadband deployment positively impacts mining, construction, and information sectors. Some of these findings were echoed in another study that found broadband expansion and employment growth vary across industries. The study found that the positive relationship is especially good for: utilities, information, finance and insurance, professional/scientific/technical services, management of companies and enterprises, and administrative and business support services. It also noted that the relationship between broadband and employment growth is stronger in places with lower population density.

According to ISER, broadband benefits can be classified in terms of:

- *Efficiency*: saving time in applying for grants and filing online reports and business data, keeping track of inventory, and managing operations;
- *Effectiveness*: increasing the quality of services provided, such as in health and education;
- *Equity*: reducing the distance barriers between rural and urban communities by providing access to information, entertainment, education, and other services not otherwise available in remote communities; and,
- *Reach*: enabling Alaskans to extend their range electronically to market Native crafts, tourism, and other local assets.

Regardless of the benefits, it will be costly to build out the needed infrastructure. It is not likely that private or public funding alone will provide the capital necessary to fully achieve the Task Force-defined broadband goals. At the same time, the Task Force recognized that the introduction of public resources must not impede the further infusion of private resources, undermine past private investment, or create unsustainable projects.

This plan is meant to establish baseline goals and recommendations including funding options that put Alaska on the road to securing faster speeds, greater bandwidth, and encouraging broadband adoption.



The Statewide Broadband Task Force

The Statewide Broadband Task Force was appointed by Commissioner Susan Bell in February 2011 to develop a plan that would accelerate the deployment, availability, and adoption of affordable broadband technology throughout the state. The 22-person Task Force was created to examine how Alaska should expand high-speed Internet to everyone across Alaska, to review the policies that should encourage broadband development, to determine the cost of needed broadband infrastructure, and to create a blueprint for the future.

The Task Force members, nominated by their respective organizations, understand the challenges of broadband deployment across Alaska and have specific knowledge of communications systems, their normative uses, and the technology that supports them. Full biographies can be found on the Task Force website at www.akbroadbandtaskforce.com.

Task Force Members/Organizations Represented		
Community Anchors & User Groups	**Providers & Suppliers**	**Government Representatives**
Stevi Morton Alaska State Hospital & Nursing Home Association	**Maureen Moore** GCI	**Rep. Bob Herron** Alaska House of Representatives
Karl Kowalski University of Alaska Fairbanks	**Mike Todd** Alaska Communications	**Former Sen. Joe Paskvan** Alaska State Senate
Mike Robinson AK Library Association	**Chris Brown** AT&T	**Rich Gazaway** Regulatory Commission of Alaska
Mike Baker Alaska Pacific University	**Dave Goggins** AK Telephone Association	**Brig. Gen. Mike Bridges** Alaska Dept. of Military and Veterans Affairs, Alaska Army National Guard
Bob Whicker AK Association of School Boards		**Jim Kohler** Alaska Dept. of Administration
Brad DeMontfort IBEW Local 1547		**John Boucher** Alaska Office of Management & Budget
Bill Popp AK Partnership for Econ. Dev.		**Renee Johnson** U.S. Dept. of Agriculture/ Rural Development
Jeff Tucker Alaska Municipal League		**Roberta Graham** Alaska Dept. of Commerce, Community and Economic Development
Myron Naneng Alaska Federation of Natives		
Joseph Davis Public Member-at-large		

Goals

The Statewide Broadband Task Force defined two key goals for Alaska.

Goals
Make it possible for Alaskans to participate and be competitive in the global community by extending the full benefits of broadband technology to every Alaskan.
By 2020, every Alaska household should have access to 100 megabits per second connectivity.

Task Force Meetings, Measures, and Consideration

The Task Force met regularly over the course of 24 months and heard testimony from organizations, municipalities, rural providers, community broadband administrators, educators, funders, government agencies, regional Native corporations, new project promoters, satellite providers, and schools/libraries. A full list of presentations can be found on the Task Force website as well as in Appendix C of this report.

The Task Force formed four subcommittees to collaborate and address the following areas:

- Regional, national, and global competitiveness;
- Commerce needs and opportunities;
- Health care needs and opportunities, including economics and services;
- Government services needs and opportunities, including e-government and facilitation of government functions;
- Public safety needs and opportunities;
- Educational needs and opportunities from kindergarten through post-secondary, including e-Rate funding;[16]
- Library needs and opportunities, including e-Rate funding;
- Broadband adoption, education, and outreach;
- Examination of solutions for infrastructure build and operations, including costs, feasibility, affordability, timetable, and funding sources;
- Current systems and infrastructure status, especially middle-mile connectivity;
- Preparation of draft middle- and last-mile technical solutions and recommendations;[17] and,
- Federal and potentially state regulatory issues, policy research, and analysis.

In assessing the landscape for the future, the Task Force looked at four potential routes that investors and/or governments take in order to address this particular infrastructure outcome:

1. Directly enter the unserved regions as a service provider;
2. Enter the unserved regions as an infrastructure owner, but contract operations with one or more service providers;
3. Stimulate investment to make the market more attractive to private sector investment; or,
4. Enter into public-private partnerships for infrastructure and service development.

Performance Measures that Will Define Success	
Measures	**Target**
Download Speeds	100 Mbps
Upload Speeds	100 Mbps
Latency[18]	20 milliseconds (terrestrial within Alaska)
Reach	100 percent of homes and businesses with potential access/total market served
Adoption/Usage[19]	100 percent of homes and businesses with access connected; 100 percent of school and adult population
User Cost	Affordable at current rates or less
Reliability[20]	99.99 percent with backup systems
Progress	100 percent of Task Force recommendations enacted

Guiding Principles

Early in its process and based on its goals, the Statewide Broadband Task Force adopted a set of principles to guide recommendations for further action. In general, the Task Force decided that state-owned facilities would be the least desirable option because there tends to be less innovation, more regulation (especially to enforce open access), and they may produce unintended consequences for utilities. Other guiding principles included:

Guiding Principles
1. Fiber optic systems offer great capacity advantages at 100 Mbps and above, allowing for expansion to meet future needs. Based on demand alone, fiber solutions become cost effective if total demand is 300 users or more. The Task Force understands that the challenge of deploying and maintaining fiber in many parts of Alaska is difficult due to a combination of population dispersion, terrain, ice scour, vast distances, and permitting challenges.
2. Where fiber is not economically justifiable or for communities with fewer than 300 residents, microwave is typically the most affordable and technically achievable terrestrial alternative.
3. Satellite is a near-term solution for many communities, but will exhibit higher latency, which limits performance capabilities. Satellite can be deployed as a middle mile solution for wireless or wire line end users. Although satellite technologies deliver a different user experience, such solutions should be included in any final design.
4. Polar fiber projects are encouraged if project financing and deployment is a reality.[21]
5. Support funding for last-mile infrastructure where federal programs are insufficient.



Implementation Practices

In addition to the above guiding principles, the Task Force endorsed the following implementation practices.

Implementation Practices
1. Encourage private ownership of "new" infrastructure as the preferred option in order to minimize the impact on the state budget. • Current providers should competitively bid on portions/segments of the network additions to offer the greatest opportunity for each of the current telecom industry providers to leverage their business's unique needs with those of this project, while not precluding new entrants. • A competitive bid process must be utilized to use the network and ensure non-discriminatory access for all providers if public ownership is pursued. • Public funding support should be considered to augment private capital. • Infrastructure projects such as roads, ports, railroads, pipelines, and mines financed through the state budget process must include broadband build out as part of the project budget. Incent the laying of high speed fiber and utilities at the same time these major infrastructure projects are developed, and pursue the public-private partnership model to allow telecommunication providers to become partners in providing broadband as part of the infrastructure project. • Permitting processes and policies should be streamlined for utility development and deployment, use of public rights-of-way, utility easements – including broadband and telecommunications – and streamline and accelerate the process to incent major developers to invest in broadband deployment throughout Alaska.
2. Establish clear guidelines for public-private partnerships. • When public funds are provided to match private funds, the project owner should be obligated to fund operations and maintenance through a viable business plan and commit to non-discriminatory access for other providers. • Whenever public funding is used to augment private investment, the private investor should have the opportunity for return on private investment reflective of the risk but exclusive of the public investment. • For projects where broadband providers elect to bid jointly, it is expected that participating providers will share in the Operations and Maintenance expenses and proportion the capacity relative to carrier participation, while allowing non-discriminatory access to other providers.
3. Promote long-term economic and technological sustainability. (See Broadband Checklist for Funders in Appendix F) • It is not likely that private or public funding alone will provide the capital necessary to achieve fully the Task Force-defined broadband goals. At the same time, the introduction of public resources must not impede the further infusion of private resources, undermine past private investment, or create unsustainable projects. To that end, any component of public financing should: ◊ Leverage available dollars and ensure that an owner/operator has sufficient commitment to long-term sustainability by requiring a substantial loan or other private financing accompany any grant component. ◊ Demonstrate the competency, experience, and resources necessary for each applicant, as part of a competitive application process. ◊ Build on prior investments by interconnecting with existing infrastructure if possible and prohibiting duplication of existing facilities, except as required to provide network reliability.
4. Fortify essential anchor tenant customers and remove barriers to entry. • Collective anchor tenant demand is necessary to spur infrastructure investment and to provide ongoing support to completed projects. Anchor tenants ensure project sustainability by supporting return on investment and repayment of loans, while funding ongoing operations, maintenance, and future network expansions and upgrades. The State can uniquely serve and support anchor tenants to ensure investment in lasting infrastructure to meet current and future demands for service. In turn, the "support-to-anchor tenant" model ensures competitive neutrality by appropriately putting the customer, rather than the State, in the position of determining the service provider and technology that best meet customer needs. • Facilitation examples include tax incentives for anchor tenants, using the facilities for the state's administrative network traffic.

Alaska's Challenge: The Need for Better Broadband

Alaska ranks near the bottom of all states within the United States in some important broadband categories. It is among the lowest-ranked of all states in terms of high-speed broadband Internet access and the percentage of households with multiple wire line providers, according to a 2011 report by the National Telecommunications and Information Administration (NTIA).[22]

There are reasons why Alaska's communications infrastructure is still developing and has not yet reached the entire population:

1. **Geography**. The geographic breadth and challenging terrain make much of the state hard to service from an economic perspective and make building, maintaining, and providing communication services at an affordable price for the end user difficult.
2. **The Economics of Build Out**. Even with the fast-paced change of communications technology, which brings more efficient and cost-effective solutions over time, the economics of statewide broadband infrastructure deployment remain challenging.
3. **Lack of a comprehensive strategy**. To connect all communities to the level of service required by the FCC in its National Broadband Plan and the Task Force's stated goals, a comprehensive engineering, financing, and deployment plan is needed.
4. **Competing demands on public resources for infrastructure projects**. Resources to provide for a variety of demands will be stretched.

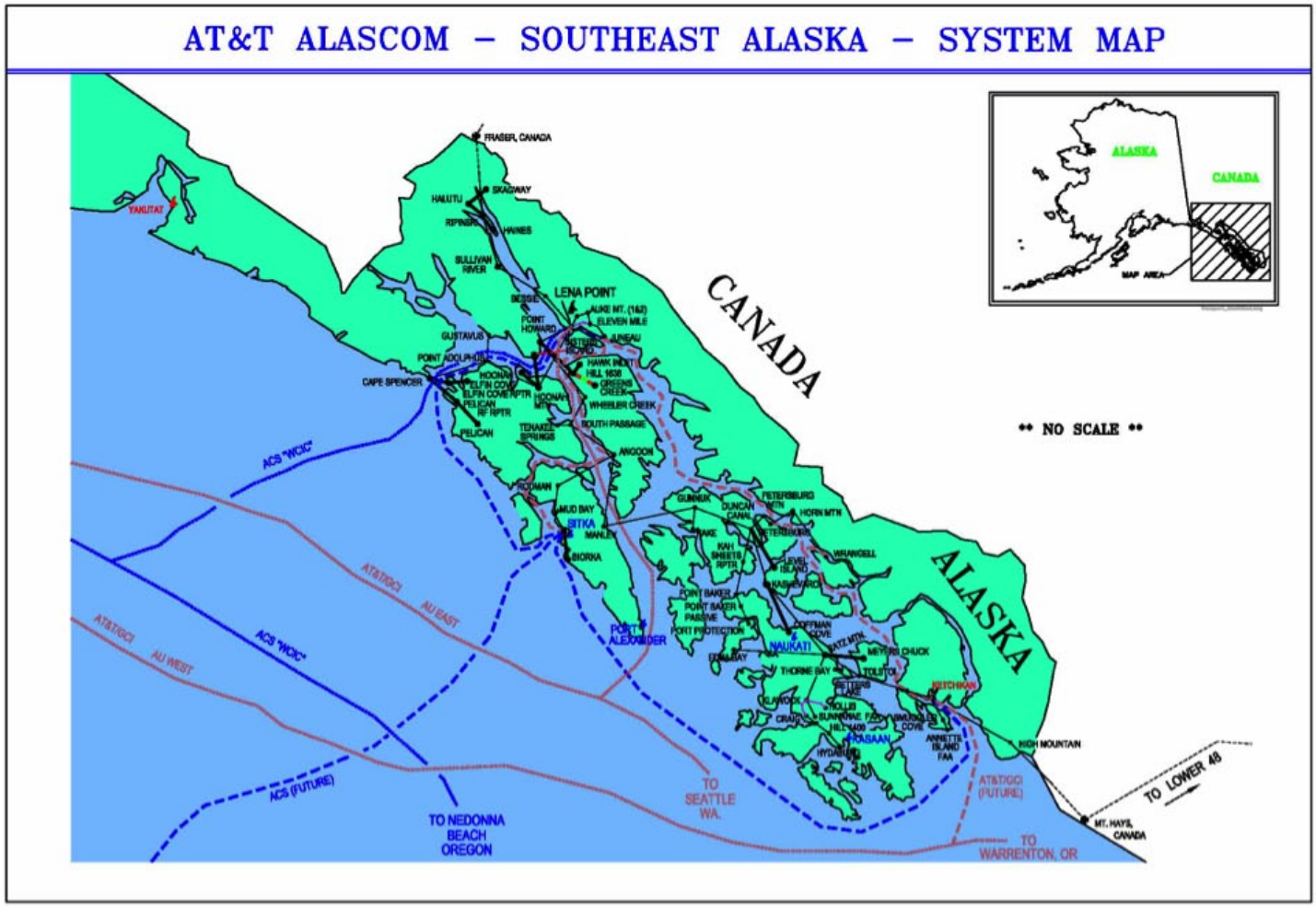
Alaska's existing middle mile infrastructure is a work in progress. As the image below depicts, the red lines represent existing high-speed fiber optic networks already in place. The blue lines represent GCI's TERRA Southwest and TERRA Northwest projects, which bring fiber/microwave infrastructure to those areas of Alaska. The new Verizon 4G LTE network utilizes the existing backbone infrastructure. The TERRA project was built with the assistance of a one-time federal grant and loan funding. Without the combination of grants and loans, the project might very well not have been undertaken. In the absence of terrestrial network, communities are typically served by satellite.

Alaska's Terrestrial Middle-Mile Infrastructure[23]



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

Detail of S.E. Alaska Middle Mile Infrastructure 2012[24]



AT&T Alascom

The issues surrounding greater broadband deployment and adoption are also inclusive of whether or not communities are going to fully participate in the economy. There is a gap between the level of service available in remote areas of Alaska and that of urban areas, causing serious challenges to residents.

In the ISER study, communities in the GCI TERRA Southwest service area were examined prior to the offering of faster broadband service to determine the anticipated use of broadband and whether better connections/faster speeds would be adopted by households and businesses.[25]

ISER found that:

- Internet use is widespread in remote communities, and two-thirds of users are online almost every day. Although many people in the region are already "Internet-savvy," most are dissatisfied with slow speeds and uneven quality of service, and would like faster and more reliable connections.
- Community access is important for Internet users, including among those with home subscriptions. Outside the home, users access the Internet at work, school, libraries, and tribal offices. About 60 percent say members of their household access broadband elsewhere in the community, even if they subscribe at home.
- There is definitely enthusiasm about broadband -- only 8 percent think their households would not subscribe, while 45 percent think their households would definitely sign up for broadband. The remainder of those surveyed [*are not sure*] are primarily concerned about overall cost, monthly subscription rates, overages, or other charges.
- Uses of broadband vary. Personal communications and entertainment ranked highest (social networking, downloading music and video, playing online games). However, 48 percent said they expected to use broadband for education, 45 percent said they would use Skype or similar services for videoconferencing, and 39 percent said

they would use broadband for work/telecommuting.The interest in education and telecommuting indicates that broadband could help residents upgrade their education and allow them to work from their homes or communities. Other services residents thought they would use include online banking, travel reservation services, and online shopping.

- Cell phone penetration is high, with 87 percent of households having at least one cell phone and 60 percent of households having a smartphone. However, bandwidth and speed are limited for these applications. Some residents take their smartphones to school where they can use the WiFi connection. More than 50 percent also have an iPad or other tablet or e-reader. Clearly there will be demand for mobile broadband. Finally, the ISER study found that in many locations, more than one-third of households have a VSAT (very small aperture terminal) satellite antenna due to the lack of access to broadband by other means. Some 88 percent of satellite users accessed government services online, 87 percent accessed financial services, 68 percent used the Internet for education, and 62 percent for work or telecommuting. These early adopters provide an indication of future broadband use for work, education, and public and private sector services. The ability to generate wealth, improve education, and access services depends highly on the Internet to deliver needed educational and medical services which contribute to the overall sense of well-being for residents of these communities.

The following comments, gathered from rural residents, educators, and community officials, further underscore the impacts of slow or non-existing Internet connections:

"Internet access has arguably been a challenge since the Naval Base closed in 1997… we are limited to satellite for off- island traffic, which has a high latency and is very easy to disrupt, either through solar interference, high winds, or the satellite provider moving the satellite in and out of range. Satellite is very expensive, leading to Adak having some of the highest costs of service with limited speed and throughput allowances. With these limitations our community, including the city government, must heavily restrict usage to essential traffic, which sadly does not include security software or utilization of services such as distance-training, web conferencing solutions, and other efficiency tools now available to broadband users."

Layton Lockett, City Manager, Adak

"High schools need to offer core classes for AK Performance Scholarships… to tap into online classes to get students to qualify for these scholarships. Offering college/AP courses has been difficult with our limited bandwidth."

John Conwell, Superintendent of Unalaska Schools

"We have lots of single points of failure. Better redundancy and higher bandwidth would be good. With the latency, it is hard to host a videoconference."

Jim Jones, IT Manager, UAF Bristol Bay Campus

"We use broadband in our clinics. We are moving towards using video in consults. We now have 5 Mbps via satellite paid for with USF funding. It is doing what it needs, but it is behind our need curve."

Edgar Smith, Eastern Aleutians Tribes

"Since our grant funding for our dedicated T1 expired, it is hard to run the school."

Adelheid Herrmann, Southwest Alaska Vocational Education Center

Economic Opportunity

Today's global economy depends on fast broadband. A World Bank study[26] concluded that every 10 percent increase in broadband penetration accelerates economic growth by 1.38 percent in low- and middle-income countries, which are, perhaps, more comparable to Alaska's rural economy than national economies of Organization for Economic Co-operation and Development (OECD) countries.[27]

According to the Arctic Communications Infrastructure Assessment (ACIA), several studies show that investments in IT and broadband have been favorable for social development and that countries that have invested heavily have also experienced higher productivity. The competitiveness and productivity of businesses can increase through more efficient production of goods and services, logistics, and new business processes. Broadband makes it possible to work remotely. It enhances the ability to launch and run a business from anywhere. It means that people are able to work where they live instead of having to live where they work.[28]

In Chevak, a community of approximately 900 people located near the Western Alaska coast, Native artisans are renowned for their work in basketry and doll making. Now efforts are underway to preserve traditional art skills though enabling the younger generation to use their technology skills to create websites that highlight the older generations' artwork and make them available to the world for purchase. The result: village e-commerce and an income stream for Native artisans. The creative process had Elders bringing their artwork to the public school, where Internet designers used mobile phone/tablet cameras and mobile apps to take pictures of the artwork. Specifically, the YouSpin app for iPhone/iPad was used to make 360 degree product photos that were uploaded to the Elders' e-commerce website. A good example of this work can be seen at http://chevak.weebly.com/. Here Maggie Atcherian's work is shown on a website created by her 12-year-old grandson, Matt. Through this effort, both generations are involved in sustaining cultural practices and bringing them to a global audience.

The collaboration between Elders and their grandchildren would not have resulted in e-commerce without good broadband connectivity, a key to this effort's success. Reliable connectivity with increased bandwidth speeds allows for the inclusion of multiple methods of payment, the use of multimedia, the addition of their sites to established marketers such as Etsy and Ebay, and the options of different income producing methods for the village. As the broadband capacities become more available and affordable, villagers in Chevak can fully participate in online activities and e-commerce opportunities.

In other parts of Alaska, representatives from the website Etsy, headquartered in New York, visited five Alaska communities to research the opportunities and challenges of setting up Etsy online shops. The Alaska Native Arts Foundation hosted three community events to introduce and inform artists about Etsy in Anchorage, Savoonga, and Nome where more than 20 artists attended. The Etsy team assisted nine Alaska Native artists in Savoonga, Nome, Anchorage, Wasilla, and Sutton to establish online shops.

Etsy's video on Inupiat artist Sylvester Ayek helped him realize 10,830 views and earn a profit on the sale of his work. To date, artists including Ayek have sold 16 pieces, proving that Etsy is an e-commerce option for Alaska Native artists to market their work. Here again, the key is Internet connectivity in the regions. In the urban centers, broadband speeds are robust and facilitate the Etsy e-commerce opportunity. In more rural areas, the common complaint is that the Internet is very slow.

Of course, businesses in Alaska will always have to contend with the physical realities of their operations, but higher-quality access to services through the Internet can have a profound impact on a community's economic opportunities:

- Economic growth can lead to business opportunities through joint venture, individual entrepreneurship, or public-private partnerships. Communication technologies are a key element to any business, especially those involving partnerships. Communities with poor communication links will be at a disadvantage.
- For many communities, postal service, facsimile, and memory sticks are still the main communication modes.
- Higher-quality access to services can positively impact Document/data transmission since Internet service is often inadequate and large file transfer impossible. This can slow the speed of business, frustrate users, and cause disruption to communication on important issues.

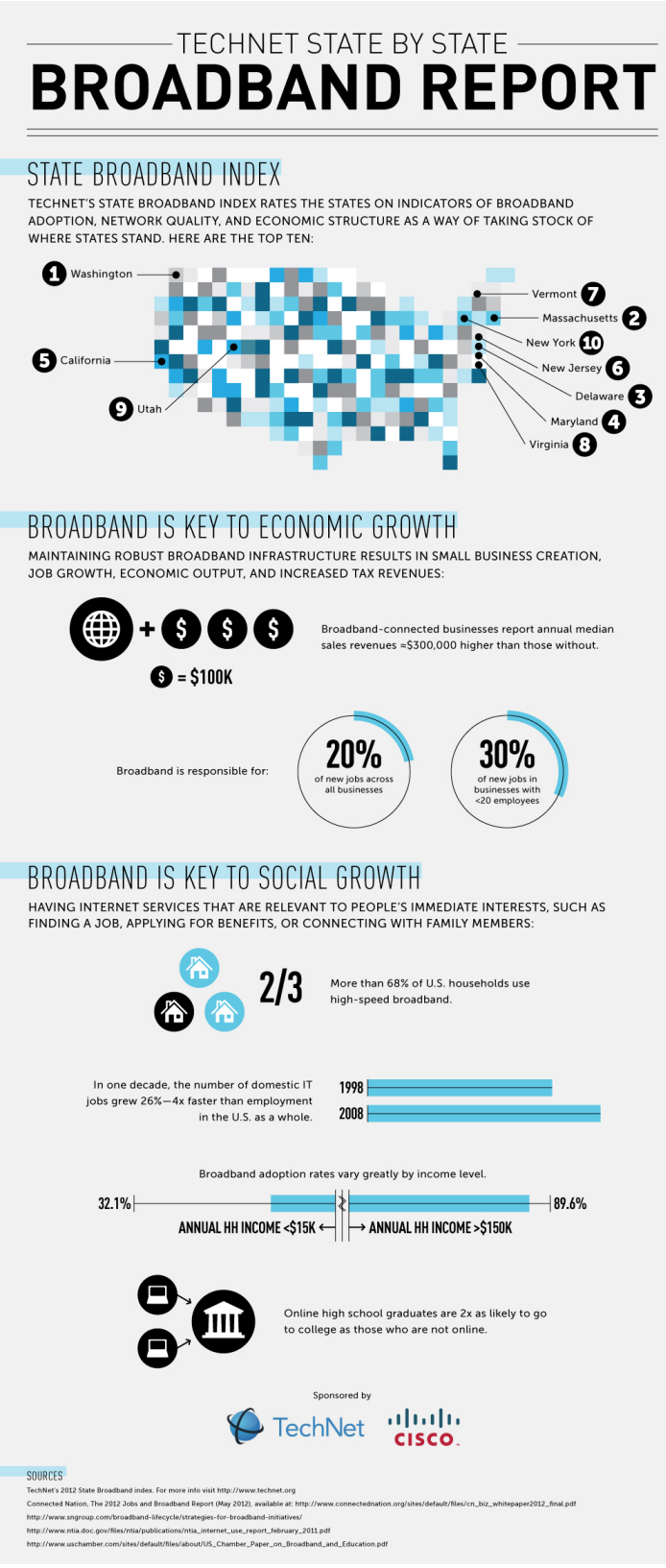
- With other areas of the country and the world operating at faster broadband speeds, communities without such access are at a significant disadvantage.
- Internet access also offers a means to purchase supplies and equipment, which can reduce the cost of doing business.

In its comments to the NTIA in 2009, the State of Alaska said broadband could facilitate e-commerce and other e-service applications in rural Alaska:

> *"The availability of the Internet through broadband access offers the best method for advertising goods and services in Alaska's rural communities. Enterprises such as ecotourism businesses and Native handicrafts are just two examples of how broadband can aid economic development. Internet access also offers a means to purchase supplies and equipment, which can reduce the cost of doing business. Additionally, broadband access encourages businesses to take advantage of the full range of internet services such as federal tax preparation and reporting, Internet banking, grant and loan applications, participation in training opportunities, networking through trade associations, research and general communications"*[29]

More entrepreneurs are working from home, which typically requires high-speed broadband. Social media is becoming increasingly important, and broadband is necessary to support those platforms.

State and local policymakers must take these market conditions into consideration when establishing telecommunications policy, funding, or incentives for the development and deployment of broadband solutions to all of Alaska's citizens.



http://www.technet.org/wp-content/uploads/2012/12/TechNet_StateBroadband3a.pdf

Facts About Broadband and Jobs

Greater broadband availability is in Alaska's best interest in order to grow the tech economy as well as to create knowledgeable workers and future jobs statewide. Today's entrepreneurs demand reliable, high-speed broadband in order to meet their obligations and grow their businesses. As high-speed broadband becomes available, statistics show that economic activities increase and have the potential to become a transformative platform for innovation and growth.

According to Information & Communication Technologies, the effects of broadband on job creation can be significant. For each direct job created because of greater broadband technology, between 1.4 and 3.6 indirect and induced jobs are created.[30] This positive employment also includes the jobs created due to construction of broadband infrastructure and networks.

"Direct and indirect job creation will likely be more immediate," the report said. "In contrast, induced and especially transformational jobs creation (industries that locate to an area/jobs created due to long-term employment opportunities/ outsourcing and self-employment) will take more time to appear, although such forms of job creation might have longer-lasting and deeper impacts."[31]

Other studies and reports show that growth in the private sector among information services – including publishing and telecommunications jobs – accelerated in 2011, growing 5.1 percent after growing 3.0 percent in 2010.

Yet research conducted in 2011 by Connect Alaska,[32] the state of Alaska's designated entity for the U.S. Department of Commerce's State Broadband Initiative, found that:

- An estimated 6,000 businesses in Alaska are without broadband; and,
- Alaskan businesses that can access and use broadband service report annual revenues $200,000 greater than Alaskan businesses that cannot or do not adopt broadband.

1

"The Bureau of Labor Statistics forecasts that jobs depending on broadband and information and communication technologies (ICT)—such as computer systems analysts, database administrators and media and communications workers—will grow by 25 percent from 2008–2018, 2.5 times faster than the average across all occupations and industries."[33]

2

"Broadband is becoming a prerequisite to economic opportunity for individuals, small businesses, and communities. Those without broadband and the skills to use broadband-enabled technologies are becoming more isolated from the modern American economy. This is due in part to the rapidly changing nature of work in the digital age. Sixty-two percent of American workers rely on the Internet to perform their jobs."[34]

3

"A new national report shows that U.S. public libraries continue to expand as technology centers for communities, providing essential resources for job-seekers and support for critical e-government services. In addition, as the demand for e-books increases, libraries are the starting place for free downloads. … More than 74 percent of libraries offer software and other resources to help patrons create resumes and employment materials, and 72 percent of libraries report that staff helped patrons complete online job applications."[35]

4

"Online Marketing (online resume posting) yields an 8 percent chance of success in uncovering the next opportunity. This rate matches those of 2003 when this strategy was still in its infancy. A blended strategy of using social networks like LinkedIn, Twitter, and Facebook, helps identify referral opportunities."[36]

Alaska's Tech Community

Economist and author Richard Florida said in his recent book that robust economies offer three key elements: talent, technology, and tolerance.[37] To illustrate the first two propositions, the Task Force surveyed the growing number of Alaska's Internet entrepreneurs and found reasons to be optimistic. In Anchorage and Fairbanks alone, there is a growing community of entrepreneurs in the tech sector, including:[38]

Splatapult Game Studio, Anchorage, develops unique, creative, fun, and successful mobile games ranking in the top ten in Apple's App Store, with one game selling nearly 2 million copies. Splatapult has five games in development, including one that is ready for immediate release, targeted at 38 million gamers in North America, Europe, and Asia.

Rogers Software, Fairbanks, Rogers Software Development Inc. (RSD) is a full-spectrum software development company offering consulting and "hands on" services in all areas of applications development: requirements gathering, project planning and management, development, quality assurance, training, installations, and support. Rogers develops and supports SuperSalon, the world leader in point-of-sale software for the salon/personal services industry. SuperSalon is licensed in over 11,000 locations.

Simply Social, Anchorage, develops new software that helps businesses more easily use social media sites like Facebook, Twitter, and YouTube for marketing. The software could also help political candidates and elected officials reach voters and constituents. (The company's tools helped Rep. Mia Costello garner support for House Bill 252 in 2012 to exempt start-up technology firms from state corporate income taxes until a company's assets reach a certain level.)

Design-PT, Anchorage, is a full service, Alaskan-owned service provider dedicated to supporting health care and human service organizations throughout Alaska. For nearly 10 years, DPT has provided highly skilled, specially trained IT support staff and specialized services, with a focus on simplifying IT for clients.

Sequestered Solutions, Anchorage, provides information technology expertise to select clients on a local, national, and international level. Because half of the company's clients are government-based, it excels in providing complete security at low costs. Services include: security analysis, virtual system design and conversion, system certification, and accreditation.

Mind Matters, Anchorage, was first conceived by Lyn Freeman in 1992 to offer evidence-based training and classes on mind-body interventions, complementary and alternative medicine, and integrative health care. Early customers included the University of Alaska Anchorage, Alaska Regional Hospital, Providence Hospital, and individual chronic disease patients. Freeman was awarded a National Cancer Institute grant in 2004 and subsequently created the ENVISION Behavioral Medicine Intervention.

PangoMedia, Anchorage, was founded in 1997 as an Alaskan IT consulting firm that provides software engineering, document management, business intelligence, and staffing solutions for its clients. Its customers include federal, state, and local governments, Alaska Native corporations, and private sector companies in the oil and gas, telecommunications, and medical fields. In 2010, PangoMedia was a runner-up for the coveted Anchorage Chamber of Commerce "Best Business" Gold Pan award based on its commitment to its community, employees, and clients.

GearSpoke, Anchorage, is a website offering a forum for people in Anchorage to rent outdoor gear from neighbors on the cheap (peer-to-peer rentals). Listings include tents, outdoor grills, kayaks, fishing equipment, and skis. Financial transactions are completely secure through PayPal.

Tenant Watch, Anchorage and Fairbanks, is a Consumer Reporting Agency that has been providing fraud prevention and risk reduction tools for property managers since 1994. Tenant Watch provides a service to screen potential renters, helping landlords with only a few units to multi-property management companies. The growing service inspects credit reports, eviction history, and other court documents including sex offender lists. The resulting report has a typical turnaround time of within 15 to 30 minutes of receiving a renter's application.

The Transformation of Education

Online curriculum, mobile technologies, open online courses (MOOCs), videoconferencing, and improvements in distance education not only change the way education is delivered but transform how students learn at all levels—K-12, post-secondary, vocational training, and continuing education. Alaska's ability to take advantage of these new educational opportunities depends on the availability of affordable and reliable broadband.

The availability and quality of online curriculum continues to improve but continually demands higher bandwidth for video and continuous data transmittal. Access to adequate bandwidth translates directly to better opportunity and improved chances of higher student achievement. These levels of bandwidth are limited by cost and delivery options. Satellite delivery of faster speeds and more bandwidth is currently cost prohibitive unless school budgets are supplemented or re-prioritized. Satellite broadband to remote areas and the latency accompanying it are complicated by complex educational applications that require continuous data transmittal over the Internet.

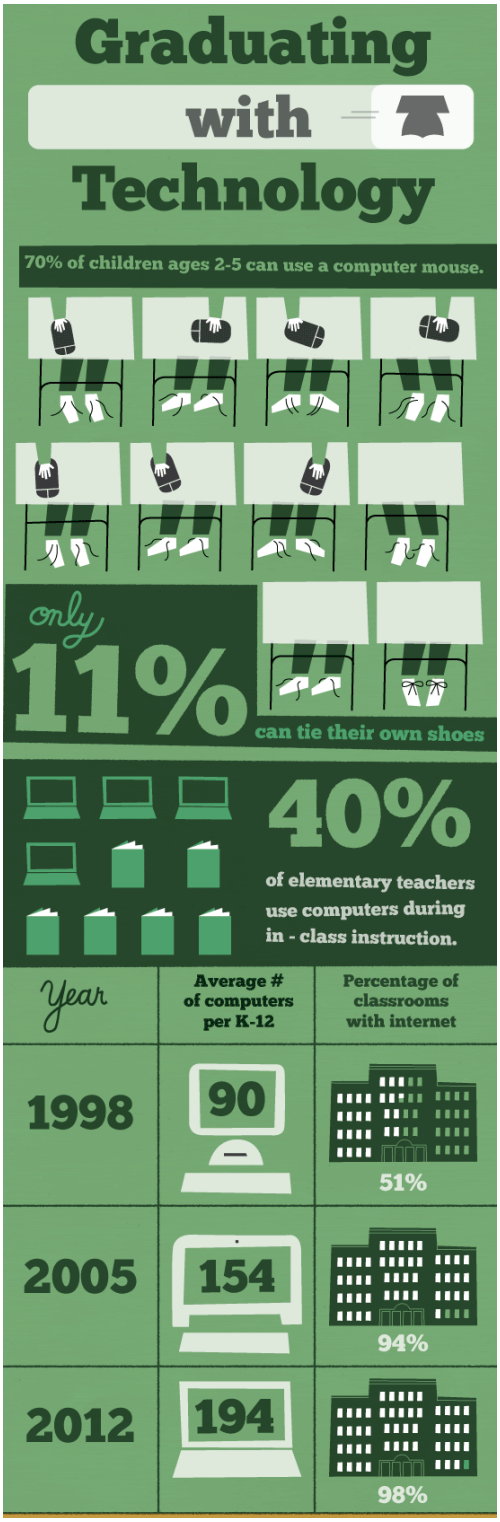
In 2013, Gov. Sean Parnell led a digital learning effort when he recommended increased funding for the Department of Education and Early Childhood Development to expand a one-to-one learning scenario for every one of the 129,000 K-12 students and 83,000 teachers in Alaska by the end of 2017. If funded, the program would be administered by the Alaska School Board Association's Consortium for Digital Learning (CDL) and would be phased in over a period of four years in cohorts of approximately 25,000 students and teachers per year. The CDL has been a catalyst for the Alaska Digital Initiative, which is dedicated to providing teachers and students a digital platform for learning, support for implementing digital and distance programs through CLD's "iTunes U" and the state's "Digital Sandbox" programs, and creating digital workshops throughout rural Alaska to help communities better understand the digital economy.

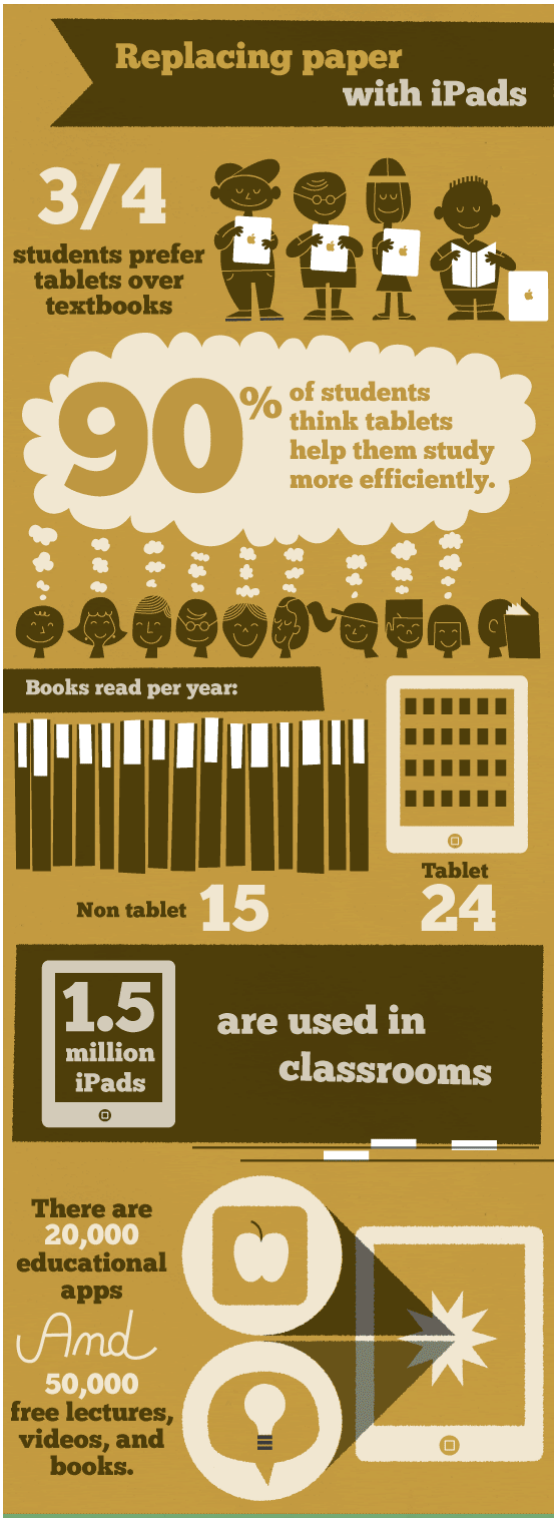
The initiative remains an important tool for delivering distance education throughout Alaska's schools.

Legislation to support broadband in public libraries and to promote broadband access for schools was also introduced in 2013. Currently, schools that cannot afford enough broadband or do not have available broadband have to make decisions to limit what kinds of educational content can be downloaded and who can access this information.



The mandated online testing capability is coming for every school in Alaska in the very near future, and high-speed broadband is a particular challenge. A recommendation in June 2012 by the Smarter Balanced Assessment Consortium suggested a minimum of 5 - 10 Kbps per student for online assessments in 2014-15.[39] This would mean 1 Mbps per every 100 students for testing. Many schools in Alaska currently would be severely limited in access for regular instruction during testing windows with this requirement.





http://www.learnstuff.com/graduating-with-technology/

Mobile technology is helping many schools improve student achievement. In an iPad project across nine Alaskan school districts, students are showing improvement in reading literacy and comprehension through an online differentiated reading program.[40] Schools that did not have adequate bandwidth had scheduling issues when accessing the program, while schools with adequate bandwidth had no such problems and could use the software anytime without fear of taxing their bandwidth. While almost all students showed increased achievement, students who had the ability to access the program online at home showed significantly more improvement over those who did not access the program at home.[41]

There are currently more than 120 schools in Alaska with high technology-use learning environments through one-to-one programs associated with the Association of Alaska School Board's Consortium for Digital Learning (CDL). In these schools, students and teachers have a dedicated digital device (laptop or iPad) throughout the year. These devices are used in the regular curriculum to expand access to resources, engage students through personalized learning, and allow access to curriculum in online programs. About 12 percent of all Alaska students participate in such a program, with more students coming in every year.

Videoconferencing has become a mainstream method of delivering instruction throughout Alaska. For example, the Lower Kuskokwim School District (LKSD) maximizes its use of highly qualified teachers by using videoconferencing to deliver core instruction between remote schools in its district. LKSD also uses videoconferencing to provide language immersion classes in Yupik, the aboriginal language of the area. The Kodiak Island Borough School District delivers music and math instruction through videoconferencing to its rural schools from the City of Kodiak Schools. In Southeast Alaska, the Chatham School District has synchronized schedules between all of its island schools so that all students may participate in classes through videoconferencing.

More than 10,000 students are served through out-of-district correspondence schools operated by other Alaska school districts. These programs offer educational opportunities to students with individualized needs and desires that can't be met in regular school. The parents of these children may have specific curricular wishes, different strategies to meet special needs, or special circumstances. Many correspondence schools depend on distance delivery of curriculum and strong online communication between parents and teachers. Limitations in bandwidth at school and at home can limit curricular options just as it can in traditional brick and mortar schools.

In post-secondary education, both the University of Alaska and Alaska Pacific University offer distance learning courses and programs. The University of Alaska, which serves 17 campuses throughout Alaska, is highly dependent on broadband services to provide world-class education and conduct nationally and internationally renowned research. The university has seen an eight-fold increase in its research and education network demand since 2007, growing from 155 Mb to 1.24 Gb in 2012. Bandwidth demands to rural campuses have increased from 256 Kb in 2007 to 5 Mb in 2012, a nineteen-fold increase. It is anticipated that the demand for high quality, high-speed videoconferencing, e-learning, and resource access will only continue to grow as the university competes to deliver excellence in its educational programs.

Alaska is already experiencing the benefits of Internet usage in the education systems with e-learning. E-learning is planned learning that predominantly occurs in situations where a student is not required to be in a pre-determined location.

E-Learning courses require communication through instructional technologies. The courses are delivered in many forms, including videoconference, audio conference, tele-courses, satellite telecasts, and courses available via the Internet.

In 2012, about one in three University of Alaska students took an e-learning course, compared with one of four in 2006. University data shows that students who take at least one e-learning course are more likely to graduate with any degree or certificate than students who take no e-learning courses.

Some of the outstanding statistics that have been compiled are:

- The number of e-learning courses at University of Alaska rose by 15 percent in the past 5 years, from 2,747 in 2008 to 3,166 in 2012;
- In 2012, 19,022 University of Alaska students participated in one or more e-learning courses, 28 percent more than in 2008 (14,868); and,
- The number of graduate students taking e-learning courses has more than doubled since 2008.

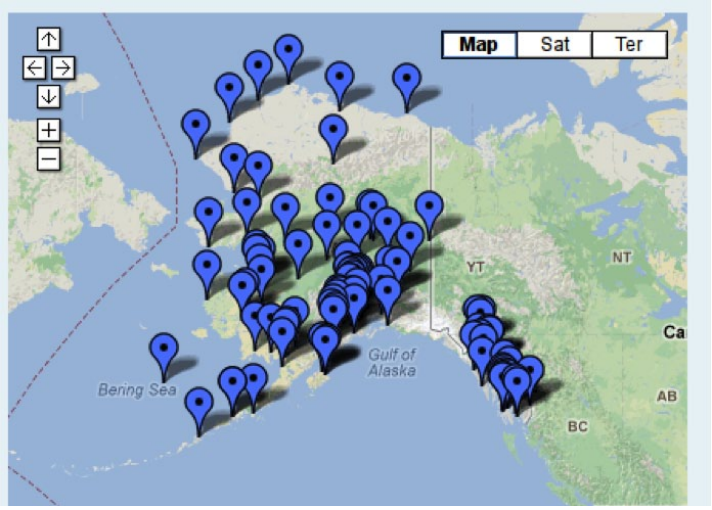
Libraries in the Digital Age

Libraries in Alaska play a vital role as the only anchor institutions in some communities. Public libraries are often the only provider of free Internet access in a community. According to a recent study, 41 percent of urban areas and 70 percent of rural areas in the U.S. are dependent on such access.[42]

Likewise, the advent of the Internet and digital media have not diminished the relevancy of libraries, but rather just the opposite. Public libraries have seen an increase in traditional activities such as borrowing books while at the same time becoming hubs for a wide range of online activities. Recent changes in the publishing industry have led to a dramatic shift in library collections toward the use of e-books and digital subscriptions that require online access to read or download.

Yet, public libraries in Alaska struggle to meet the expectations of their patrons for adequate and reliable connectivity. For many Alaskans, especially those in rural areas, the library is their only way to access the Internet. While most libraries in Alaska have some level of connectivity, it is often expensive and of low speed and high latency, making simple activities such as uploading a resume painfully slow, and high bandwidth activities, such as distance learning, often impossible.

Public Libraries in the OWL Project



Of the 98 Alaska public libraries in Alaska, 69 have moved away from dial-up speeds through assistance from the Alaska OWL Broadband Technology Opportunities Project. Of those with the improved bandwidth, 41 are in off-road communities where the majority (66 percent) depend on satellite for bandwidth delivery. http://library.alaska.gov/dev/owl.html



Alaska public libraries lag behind the national average in terms of connectivity, with 55 percent of libraries connecting at less than 1.6 Mbps, versus only 23 percent nationally. Only 38 percent of Alaska libraries reported that their Internet connectivity was adequate, versus 58 percent nationally.[43]

> ***The Alaska OWL Project*** *is a grant-funded initiative designed to increase the technology capabilities and connectivity of public libraries throughout Alaska. Its mission is to provide all Alaskans with the benefits and opportunities that come with high-speed Internet, including e-government services, distance education opportunities, and increased access to professional development*.

Libraries not only provide connectivity, they provide learning opportunities for digital literacy and other technical skills that are crucial to broadband adoption. Approximately 80 percent of the public libraries in Alaska offer information technology training to patrons. In addition, libraries often provide community meeting rooms that are connected to the Internet for collaborative work, learning, and entertainment.[44] Through the OWL project, most public libraries also provide Alaskans access to a videoconference network.

As broadband becomes a part of the basic infrastructure of modern life, it is crucial that Alaska's libraries have access to affordable and high-speed Internet connections. Libraries are key institutions in the efforts to erase the digital divide and ensure that all Alaskans experience the benefits of broadband connectivity.

Health Care and Telemedicine



The expansion of robust, high-speed, broadband services throughout Alaska creates the foundational infrastructure that enables health care providers to improve the health of Alaskans regardless of where they live. High performing health care services such as electronic medical or health records (EMR/EHR), telemedicine, digital x-rays, remote diagnosis, electronic secure health information exchange, remote consults, as well as delivery of specific physician-to-patient care services are made possible, without distance limitations, by broadband services.

Telemedicine refers specifically to the delivery of medical care at a distance using information technology. The health of patients can be monitored remotely, and interventions can occur more rapidly. Broadband technology has enabled telemedicine to improve the quality of care, reduce costs, reduce time and travel, and make specialists more accessible to patients.

The $787 billion American Recovery and Reinvestment Act signed by President Obama in 2009 included approximately $1.2 billion in electronic medical records (EMR) stimulus, which provided for electronic medical records implementation. Hospitals and health organizations are working to complete the movement to EMR integration because they believe it will improve patient care and provide long-term savings in the health field. The electronic medical records stimulus also provided incentives to help physicians convert to paperless medical records.

By storing health information electronically through computerized medical records, health care providers are able to track patient problems more accurately and efficiently, ensuring more timely and improved patient treatment. Heightened efficiency through electronic medical records storage fosters a more effective medical practice. Having instant access to electronic health records allows providers to chart information during their patient encounters as opposed to several hours later. In theory, this enhances accuracy of the patient's health record. Proponents of EMR/EHRs also argue that digital medical record storage helps prevent filing and treatment errors. Efficiencies by doctors and insurance companies eventually lead to patients saving money, too.

For decades, telemedicine has offered the promise of technology to change the way health care is delivered. Health care delivery organizations including hospitals, clinics and physicians, as well as health care payers and government, face a set of challenges, including the rapidly growing cost of health care, inconsistent quality, and unequal distribution and accessibility.

Benefits that telemedicine can offer include:

- Specialist and consult services;
- Remote monitoring of patients' health, enabling frequent or more rapid interventions;
- Remote diagnosis and care, avoiding or delaying costly patient transportation from rural locations to urban medical centers, hospitals, nursing homes, or physician offices;
- Efficient use of providers' time;
- Reduction in travel costs for patients and their families; and,
- Equitable distribution of health services, especially between urban and rural areas, reducing the social inequality caused by geography.

A variety of telemedicine applications and services are in productive use throughout Alaska at varying degrees of maturity and levels of success. Alaska currently has four health care systems with telemedicine services:

- The Indian Health Service;
- Veterans Affairs;
- Alaska Psychiatric Institute; and,
- Providence Health and Services;

These organizations provide a range of services: telemedicine deployed at subspecialty clinics in rural communities, patient in-home monitoring, emergent acute psychiatric evaluation to some underserved communities, inpatient services for remote monitoring of intensive care patients, and real-time evaluation of patients presenting stroke conditions, suicide prevention, emergency care, and e-ICU services.

While telemedicine is viewed as a potential opportunity to alleviate some of the challenges within health care delivery systems, the fundamental mechanism underlying the delivery of telemedicine is high-speed, reliable broadband services.

Electronic health records and health information exchange are still in their infancy in Alaska, but studies across the country are showing cost savings benefits and improved patient safety through more timely access to health data and reduction in unnecessary health procedures. Patients who have access to their own medical record via an electronic connection have helped to improve medical record accuracy and have shown improvements in health and welfare.[45]

The Public Safety Network

Congress passed the Middle Class Tax Relief & Job Creation Act in 2012 creating a new Nationwide Public Safety Broadband Network (NPSBN). The legislation, Public Law 112-96, allocates the 700 MHz D Block spectrum to public safety, provides $7 billion federal funding for the network, and establishes a nationwide governance structure, the First Responder Network Authority, referred to as FirstNet.

Public safety and first responder agencies in Alaska, including law enforcement, Department of Corrections, Village Public Safety Officers, fire, emergency medical services, hazardous materials response, 911 dispatch centers, and emergency management, will begin planning for Alaska's public safety broadband network with the underlying understanding that there is a strong need for a modern, fast, robust, communications delivery network. The exchange of information between those in need and those able to provide service will be enhanced by the application of broadband services.

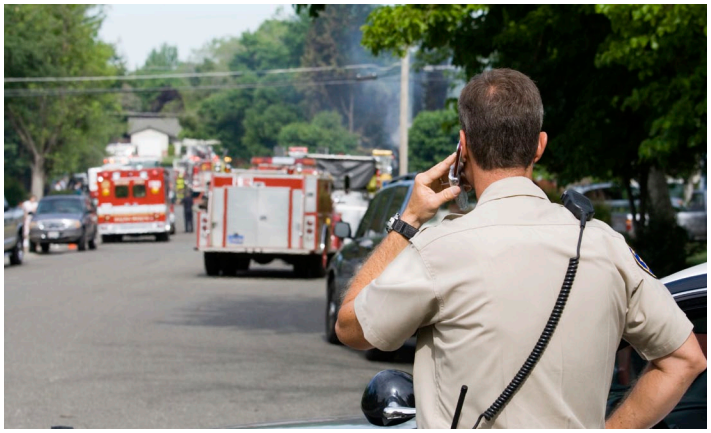
While the State of Alaska currently maintains a public safety two-way radio system called the Alaska Land Mobile Radio (ALMR) network[46] along the major state highways, there are still large areas of the state that do not have even rudimentary 911 call-taking and dispatch services. Public safety and first responders use ALMR systems because they provide a private dedicated wireless communications capability in mobile environments. The use of other systems such as cellular and the public telephone does not provide, by law, the priority and security required by first responders in public safety roles.[47]

Operating the ALMR system on the existing State of Alaska Telecommunications Systems (SATS) microwave backbone also provides a stand-alone communication system unencumbered by commercial traffic. Long-term development and expansion of the SATS requires examining the incorporation of fiber optic connectivity where appropriate, especially as the private telecommunications industry continues to expand its fiber optic footprint.

When FirstNet comes online it will have the potential to enhance and expand the State's ALMR system with a vast range of broadband public safety applications that can potentially aid all state public safety organizations in providing faster, and in many cases more cost-effective, emergency services.

Some of the services enabled by broadband include:

- Remote video display that allows scenes from rural emergency situations such as floods, earthquakes, and fires to be sent back to an emergency operations center to evaluate the scope and breadth of a disaster. For fire departments, it may include mapping of an area, pre-plans of a building, or real-time video of a large incident;
- Data management allows organizations to access data management systems in order to meet the reporting requirements that agencies may have. For example, both fire and EMS agencies have data reporting requirements to the State that are submitted electronically;
- Emergency scenario modeling software allows responders to predict evacuation areas and distances;
- Crime Scene Investigation allows local law enforcement officers to take crime scene videos and photos and transmit them to a crime lab; and,
- Computer-aided dispatch means responders can access computer-aided dispatch centers and record management systems.



Broadband and the Arctic

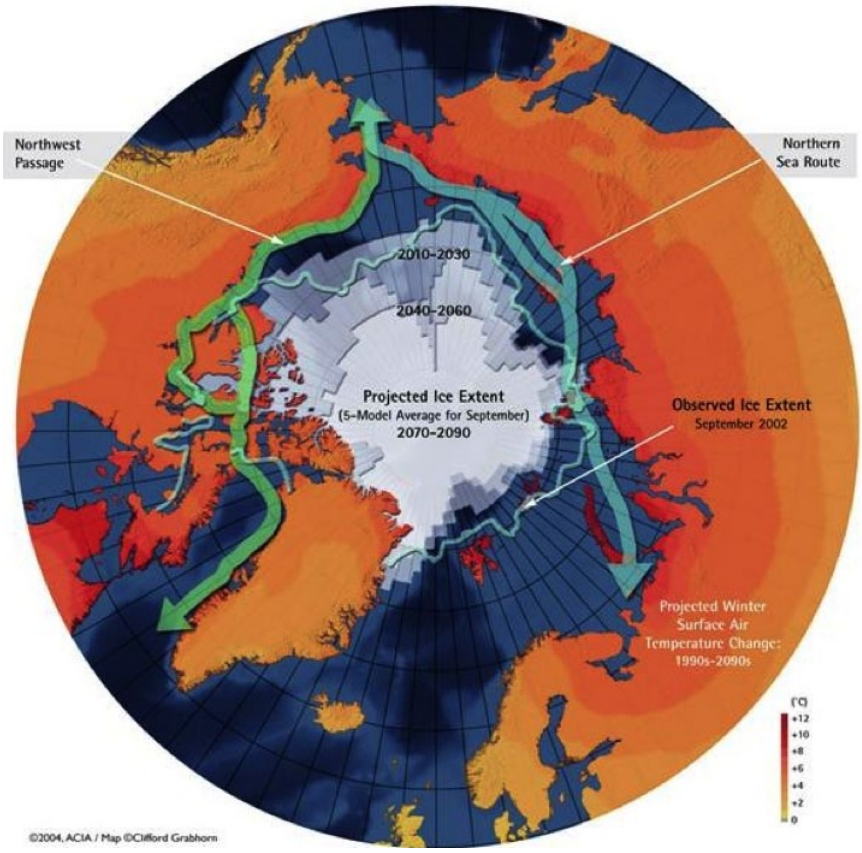
From a national and Pan-Arctic perspective, cyber-infrastructure will become an imperative as shipping regimes, national security, investments, and tourism increase. Already the United States is a signatory to the Arctic Council's Search and Rescue agreement that calls for each of the eight Arctic nations to be prepared to assist in emergency rescue operations, whether related to oil spill response or rescue of ships and passengers at sea.

"Broadband communications and connections to the Internet remain a challenge in large areas of the Arctic, thus placing limits on movements of and access to data and information, and education and outreach opportunities for northern residents," according to the Arctic Research Plan, 2013-2017, published recently by the Executive Office of the President's National Science and Technology Council.[48] "As data on the Arctic environmental systems has become voluminous, the need for more sophisticated hardware, software, standards, and sharing agreements has increased."

As the number of vessels, shipping, research, and cruise ships transiting the Northern Sea Route and the Northwest Passage continues to increase, so does the demand for increased communications capabilities in the region. The Arctic will eventually become a major transportation route.

There are two major fiber cable projects proposed to be built between Asia and Europe that could have possible opportunities for Arctic regions. Arctic Fibre LLC has proposed a fiber line linking Tokyo and London through the Bering Strait and the Northwest Passage.[49] Its Alaska-based partner, Quintillion Networks, proposes to construct five spur lines to Nome, Kotzebue, Wainwright, Barrow, and Prudhoe Bay south to Fairbanks. Polarnet, a Russian project, proposes the Russian Optical Transarctic Cable System (ROTACS) on an alternate route from London to Beijing and Tokyo through Russian Arctic waters.[50] Additionally, there is a proposed terrestrial link from Prudhoe Bay to the Chukchi Sea utilizing the Arctic National Broadband Network that was partially funded in FY12 with $4 million from the State of Alaska.

Projected Arctic Ice Extent & Sea Routes

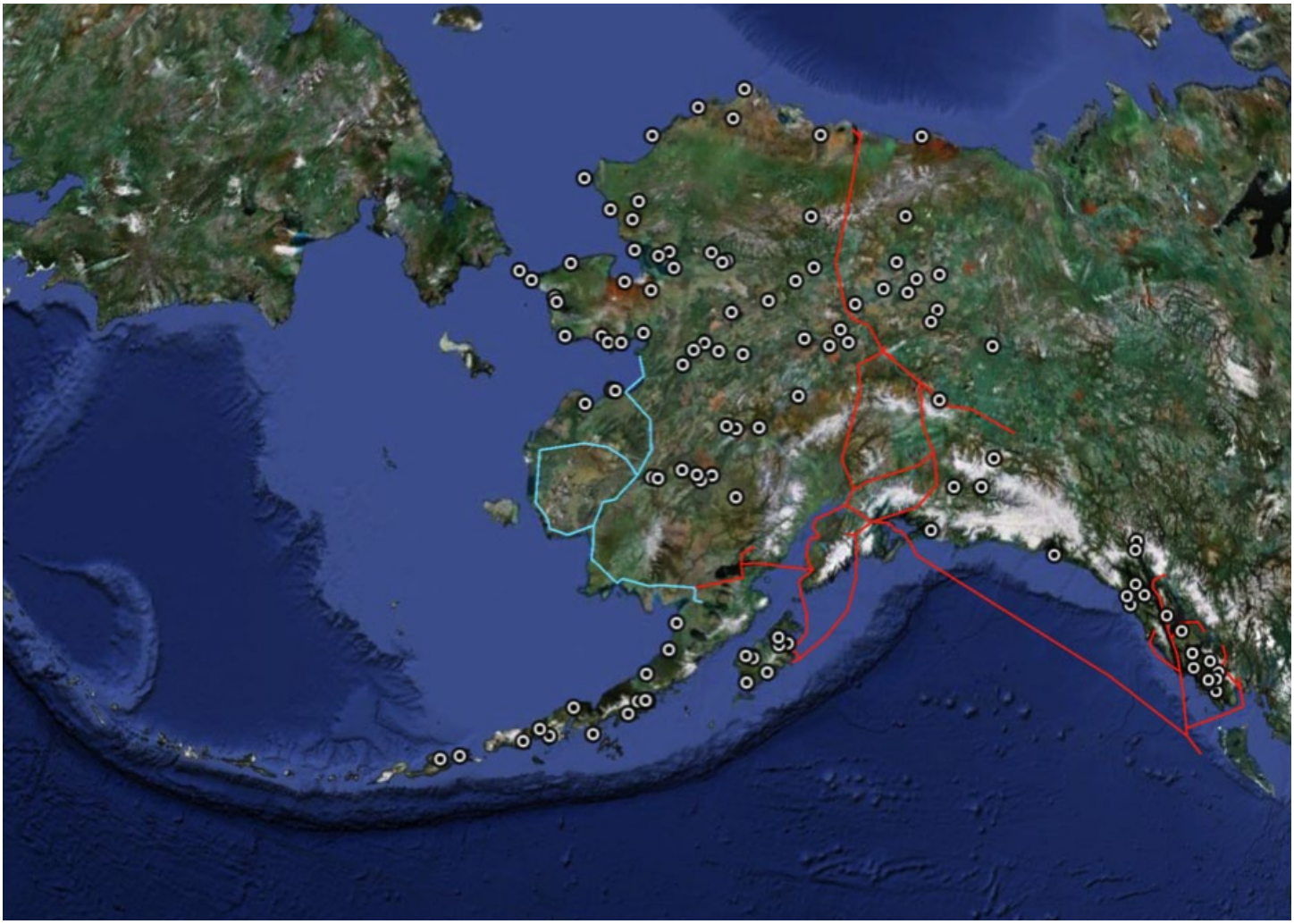


2004,ACIA/ Map ©Clifford Grabhorn

Alaska's Broadband Infrastructure

According to mapping conducted by the Scenario Networks for Alaska and Arctic Planning (SNAP) at the University of Alaska, Fairbanks, communities within Alaska that do not have access to the terrestrial high-speed fiber backbone are numerous. The locations of these places are represented by the white circles on the map below.[51]

Places Without High-Speed Broadband, 2012



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

The SNAP mapping scenario allows a user to roll over each of these map locations and access information related to that location's demographics and businesses.[52] Population figures, occupied housing, and the number of businesses are identified in each location by the Alaska Business Survey. The occupied housing is added to the number of businesses to estimate the number of broadband users. Some places are highly unlikely to have high-speed fiber and will most likely only have broadband access via satellite service. These are the communities most difficult to access and includes the villages found on the Saint Lawrence Island, the Pribilof Islands, and furthest west in the Aleutian Islands.

Terrestrial Options to Connect Alaska Communities

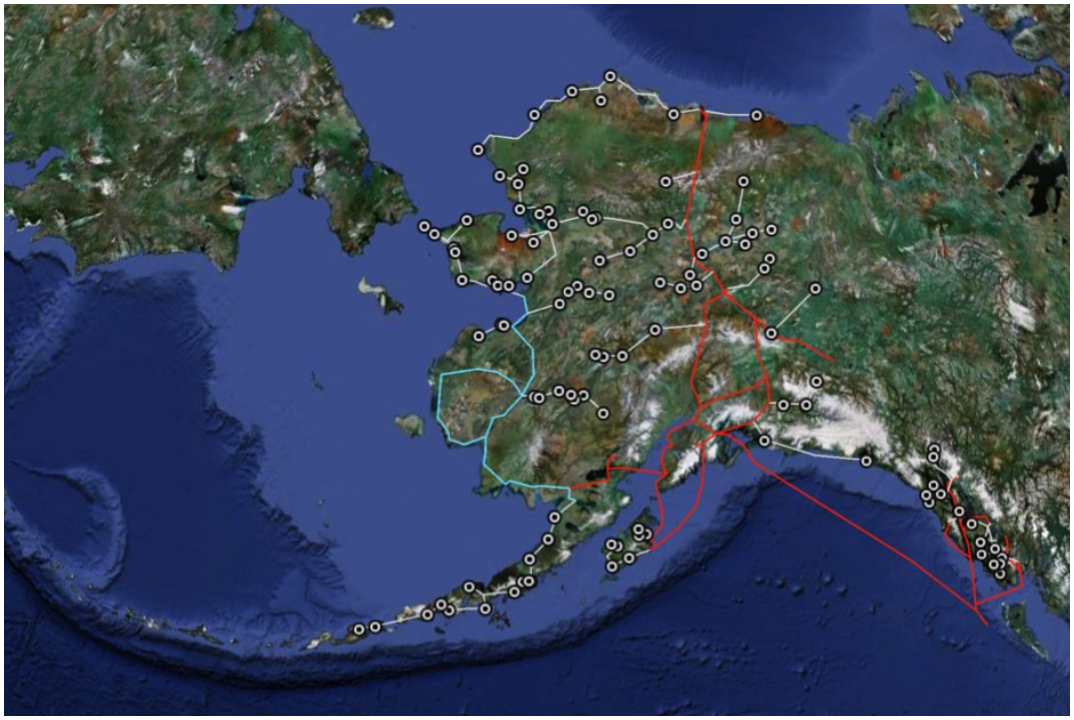
SNAP designed its broadband mapping model to connect rural locations to the existing fiber backbone. The white lines below represent the proposed network that would link the communities and villages currently without high-speed fiber. These white lines were then used to calculate the linear distance of each connection in the existing network. The linear distance is one of the variables used to estimate costs of service, along with the number of users at each location.

The cost computation was based on the number of users and the connection distance. The cost model includes providing high-speed broadband using microwave and fiber optic facilities at the 100 Mbps speed recommended by the Task Force.

When there were fewer than 300 users on the entire proposed network, microwave was the most viable economic option. But when there were greater than 300 users, fiber optic cable became a viable option to support a larger number of users. For this reason, fiber is the technology of choice for the majority of the proposed networks. Costs were estimated on the per mile cost incurred by providers to deliver the service multiplied by the number of miles from the mainline fiber to the community. Costs for specific projects will vary based on factors like location, geography, logistics, permitting requirements, and land availability.

No. of Downstream Users	M/W Cost/Mile	Fiber Optic Cost/Mile
15	$26,000	
30	$28,400	
45	$29,600	
60	$30,800	
75	$32,000	
90	$33,200	
105	$59,200	$120,000
120	$61,600	$120,000
225	$96,000	$120,000
240	$97,200	$120,000
255	$98,400	$120,000
270	$99,600	$120,000
300		$120,000
500		$120,000

Potential Routes to Connect Rural Communities with 100 Mbps Broadband



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

The Satellite Option

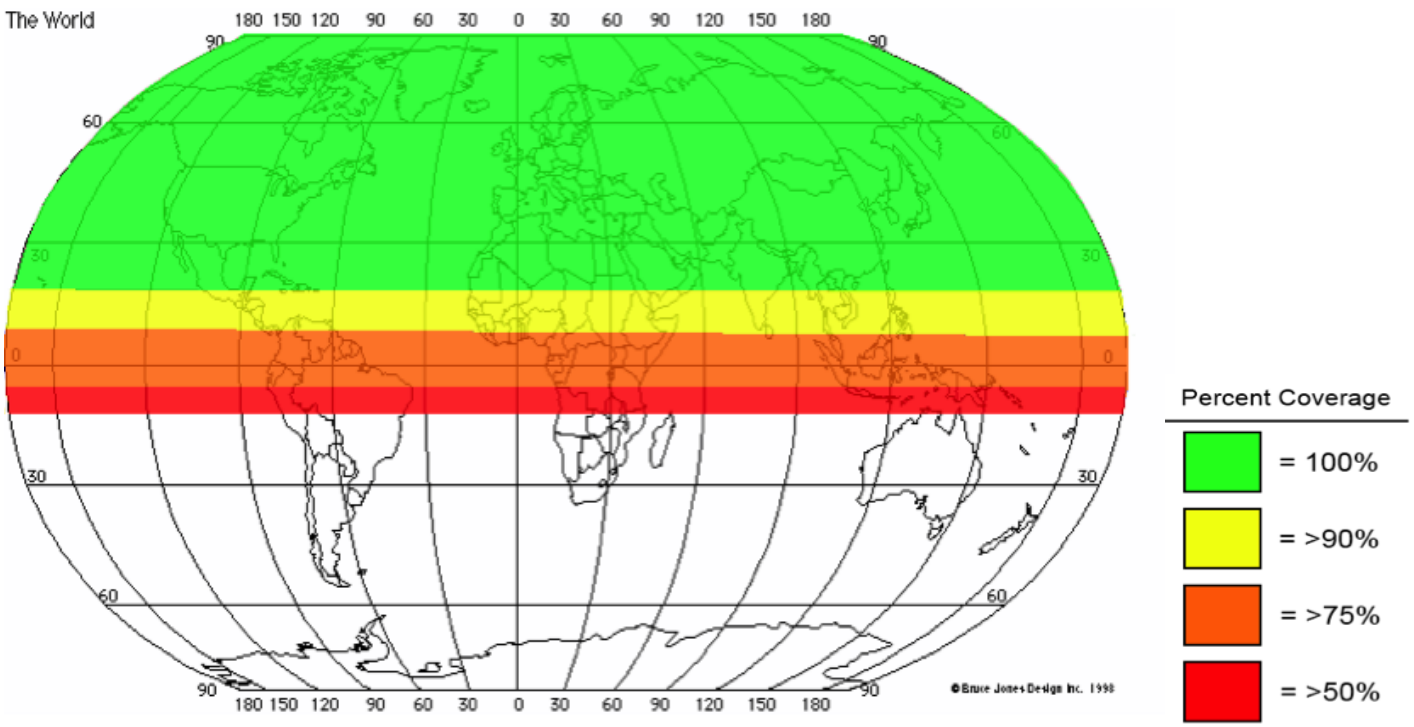
For purposes of the Task Force analysis, fiber and microwave are the "terrestrial" broadband options. The other broadband option, satellite, was considered separately because so much of the state is off the road system and hard/expensive to reach with terrestrial fiber/microwave options.

In assessing satellite options, the Task Force examined next generation geostationary satellite construction currently being planned by Viasat and Spacenet.[53] However, additional next generation satellites are likely to be launched by others such as SES WorldSkies, EchoStar, Telesat Canada, and Intelsat as their current satellites reach their end of life within the next five to ten years. The Task Force looked specifically at the cost of participating as a customer with one or more transponders dedicated to Alaska on these future satellites. The Task Force also explored with the Alaska Aerospace Corporation the possibility of constructing a series of polar orbiting satellites that would be launched from the Kodiak Launch Complex.

The Alaska Aerospace Corporation proposed a configuration of two polar launches of four satellites (one satellite on the first launch and the final three on the second launch) at an inclination of 63.4°. The satellites would be on two orbital planes (two satellites per plane) and would provide 24/7 coverage to all of Alaska and to latitudes as low as Honolulu, HI. The possibility of reselling transponders to federal agencies, security groups, oil companies, and other states was considered.

In some regions of the state, broadband delivered by satellite is the only practical alternative. Thus, the real question is whether or not the State of Alaska should be merely a customer of satellite broadband services or an actual owner of a next generation broadband satellite serving those regions of Alaska.

Internet Coverage with Four High Earth Orbit Satellites



Source: Alaska Aerospace Corporation. 2013

Mobile Broadband

Mobile, or wireless broadband, is an attractive option, but an investment in new cell towers and connecting middle mile transport networks would have to be made. According to a recent FCC filing by The Brattle Group on behalf of GCI, there were an estimated 647 cell sites in Alaska as of 2Q 2012, only 134 of which were delivering broadband speed to residents (wireless service of 768 Kbps down / 256 Kbps up).[54] The Brattle Group estimated that providing additional mobile broadband service to the approximately 17,500 unserved Census Blocks in Alaska, serving approximately 122,000 residents, would require upgrading the 511 existing cell sites and building an additional 321 new cell sites. These 832 cell sites (511 upgrades + 321 new sites) are in addition to the existing cell sites that already receive wireless service of 768 Kbps down / 256 Kbps up.

The total number of cell sites in Alaska needed to provide mobile broadband service (excluding those that already provide mobile broadband service) would be 968 (511 upgrades+ 321 new sites+ 136 existing cell sites). Even that deployment would leave about 1,900 residents unserved by wireless broadband. The cost of providing mobile broadband service to all of these targeted areas in Alaska is estimated to be approximately $596 million, including capital costs and the present value of five years of operations, maintenance, and backhaul costs.

The Brattle Group calculated the present value of five years of federal Competitive Eligible Telecommunications Carrier (CETC) and USF High Cost support for wireless carriers in Alaska to be roughly $467 million, assuming continuing support levels. Current FCC rules for providing high cost support for this type of deployment are still in development, and it is uncertain what funding will be provided at this time. Verizon unveiled its new 4G LTE network in July and has invested more than $110 million in its Alaska operations. The network, however, utilizes existing infrastructure, and the coverage area extends from Anchorage to Fairbanks, North Pole, Juneau, Eagle River, and the Matanuska-Susitna region. Additionally, GCI and Alaska Communications have agreed to combine mobile assets in a new, jointly-owned limited liability company, The Alaska Wireless Network, LLC, to reach a vast majority of the state's population.



Recommendations

During 24 months of meetings, the Statewide Broadband Task Force heard about the need for a more robust broadband infrastructure from more than 30 organizations and other stakeholders including small communities, educators, health, officials, providers, and entrepreneurs. Task Force members also examined multiple documents and reports and met with key stakeholders including educators, business leaders, and municipal executives. As such, the Task Force offers the following general recommendations to deliver 100 Megabits per second to every Alaska household as well as specific recommendations in the areas of education, jobs, and public safety.

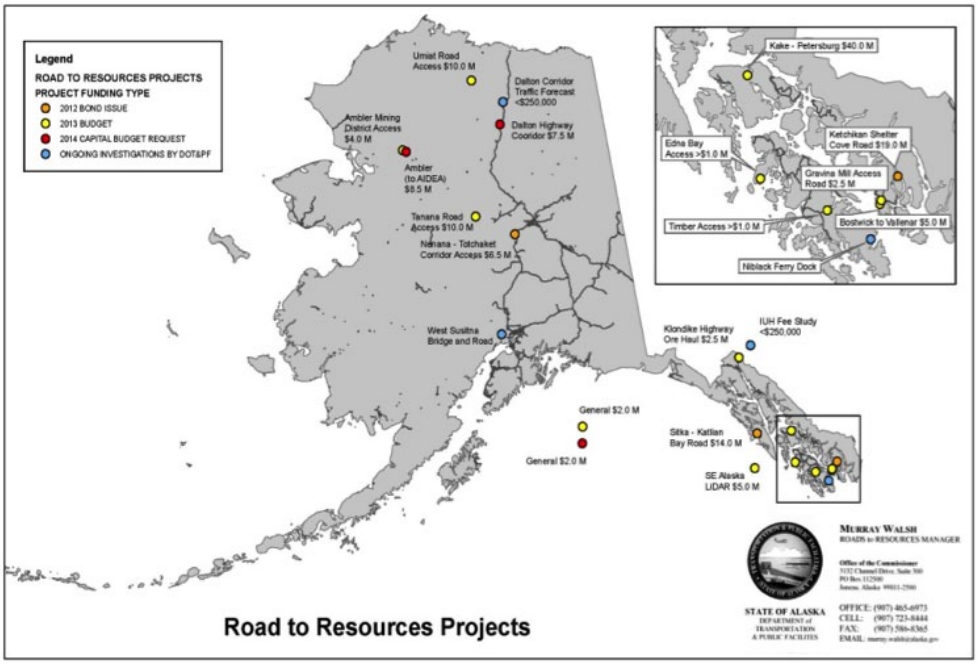
General Recommendations

Alaska should:

1. Adopt a minimum service objective of access to broadband service of 100 Mbps (up and down) to households and businesses throughout Alaska by 2020, aligning with the FCC's goal for connectivity as outlined in the National Broadband Plan.[55] This objective should:
   - Recognize that speeds and deployment would be phased in over time; and,
   - Recognize that anchor institutions, (e.g. library, school, hospital, university, public safety, and governments including federal, state, municipal, tribal, and local) should be considered drivers of service to mass market end users and may demand a service objective in excess of 100 Mbps.
2. Establish an Office of Broadband Policy to manage the statewide plan, coordinate future policy, and market the importance of broadband adoption. This office would:
   - Coordinate with other agencies regarding uniform access methods and procedures for broadband infrastructure placement on state lands and facilities;
   - Educate community leaders and key stakeholders about adoption of broadband;
   - Coordinate the development of educational, economic, and health programs adaptable to e-platforms in partnership with providers and other e-organizations;
   - Pursue programs that provide training for digital literacy and broadband adoption; and,
   - Work to ensure the adequate deployment of broadband initiatives in collaboration with stakeholders.
3. Prioritize rapid deployment of broadband access that improves current service levels. This deployment should:
   - Negotiate with national satellite providers to consider deploying high-speed spot beams throughout Alaska on planned or deployed next generation satellites;
   - Reach all locations as quickly as possible using satellite and terrestrial connections to deliver service at 10 Mbps or greater per household or economic unit. Once built, terrestrial connections can be upgraded to deliver the plan's 100 Mbps service at later dates;
   - Implement middle mile connectivity for each community starting with major hub communities based on total demand (number of homes/businesses/anchor institutions), and ensuring that communities can support the speeds offered by any initial middle mile deployment of at least 10 Mbps using all available technologies;
   - Support hub community last-mile implementation through grants and loans where new middle mile access is being deployed, such as high bandwidth fiber;
   - Encourage each community to develop and implement its own last-mile solution, compatible with the Task Force goal of 100 Mbps to every household and business so that a uniform system is developed;
   - Promote/encourage innovations and new wired and wireless technologies in the deployments; and,
   - Explore ways to incent 24-hour Internet access at community centers/meeting places and existing anchor institutions.

4. Establish technical standards to be used for the qualification of proposed construction projects wishing to gain financial support pursuant to the Task Force's recommendations.
5. Establish public-private partnerships with industry innovators and entrepreneurs to rapidly accelerate broadband development and deployment within Alaska.
   - Consider public-private partnership models for technology training, production, and adoption in communities at the margins of technology (i.e., rural, low-income, immigrant, senior populations).
6. Encourage public and private advocacy efforts to maximize federal Universal Service Fund (USF) support for Alaska.
   - Recognize and document the impacts to Alaska of Universal Service Fund reform;
   - Ensure the Alaska Universal Service Fund is targeted to support infrastructure and broadband utilization, furthering all of the Task Force goals; and,
   - Examine the Alaska Universal Service Fund (AUSF) to determine if revisions to the fund are necessary.
7. Ensure network diversity through terrestrial (overland) means on the key Alaskan high density backhaul fiber routes. For example, interconnecting with Canadian Telecom networks at key cross border points could provide fiber-ring architecture between Canada and Southeast Alaska.
8. Streamline current state e-government systems and foster improved user access, ease of use, application development, and deployment through MyAlaska.
9. Streamline the permitting process for broadband deployment projects through the Office of Project Management and Permitting (OPMP) within the Department of Natural Resources to improve financial viability and shorten broadband deployment timelines.
   - The OPMP would facilitate state, local, tribal, and private permitting/access; champion and aggressively pursue support of accelerated regulatory permitting at the federal level; conduct a broadband review as part of any state-funded project, to associate broadband infrastructure advancement complementary to the primary project; facilitate the laying of fiber in connection with roads, oil or gas pipelines, and other applicable infrastructure projects; and,
   - The OPMP would establish an online clearinghouse with links to state, federal, and local agencies involved in the project, along with links to relevant forms for permits to construct infrastructure. Other agencies involved would be asked to continually monitor the site to ensure accurate and complete information.

Road to Resources Projects



This map created by the Department of Transportation & Public Facilities details the existing Roads to Resources projects that could include high speed fiber cables in the project design.

Jobs Recommendations

Alaska should:

1. Establish policies and procedures that attract and encourage investment in "Big Data" communication industries (such as data centers) in Alaska.
2. Create training programs for knowledge workers, technicians, and web-based industries through the Alaska Department of Labor and Workforce Development that provide hands-on, long-term training to build business-level proficiency in digital media skills.

Education Recommendations

Alaska should:

1. Establish and fund the Alaska Center for e-learning and e-commerce (AkCee) under the Alaska Distance Education Consortium to stimulate demand for broadband through increased e-learning, e-health, e-government, and digital literacy programs:
    - Coordinate the needs for e-learning/digital learning (at all levels) and e-commerce, e-government, and e-health services with their respective stakeholders across the state to ensure alignment with the broadband Task Force goals;
    - Encourage the design, development, and promotion of web-based platforms for distance education;
    - Establish a shared communications network to give post-secondary institutions, researchers, and university innovators access to grid computing, cloud-based applications, tele-presence networks, and connections to academic research networks; and,
    - Incent Internet technology innovators to patent their innovations for funding purposes.
2. Create an incentive for organizations to provide digital literacy programs that facilitate broadband adoption.
3. Establish funding to help anchor institutions such as schools and libraries acquire the service goal for connectivity (100 Mbps) when it is available in their communities.
4. Establish priority funding for all universities in Alaska not connected to an academic network with the service goal (100 Mbps) to expand their connectivity infrastructure.

Public Safety Recommendations

Alaska should:

1. Ensure public safety and emergency services receive the highest priority for state and national emergency communications access to the broadband network including the state's Emergency Operations Center.
2. Future broadband planning should be done in collaboration with FirstNet and the Public Safety Broadband Network as well as with state and local providers to ensure there are efficiencies in planning, build -out, deployment, and adoption.
    - Broadband planning must ensure interoperability, focus on appropriate technologies, and leverage funding streams;
    - System upgrades should be tied to state and regional Emergency Response Coordination Centers (local emergency planning efforts, State Trooper posts, local police departments as first response / incident command centers); and,
    - Redundancy should be established for communities on terrestrial networks via satellite, the configuration of network rings, or other options.



What Will It Cost?

In addition to recommending infrastructure solutions, the Task Force evaluated the cost of new broadband infrastructure and reviewed possible funding mechanisms. The Task Force consulted others in the funding discussions, including the Alaska Department of Revenue, the Alaska Housing Finance Corporation, and the Alaska Industrial Development and Export Authority (AIDEA).

Findings:

1. The Task Force agreed that public resources should not be considered as the only funding source. In fact, it is likely that neither public nor private funding alone will provide the capital necessary to fully achieve the Task Force-defined broadband goal of 100 Mbps to every household by 2020.
2. Public funding, if available, should not impede further infusion of private resources, undermine past private investment, or create unsustainable projects.
3. The Task Force recognized that the future cost of broadband deployment would be different than estimated in this report due to a variety of factors.
4. Understanding the cost of broadband adoption, not just deployment, would be critical to develop public policies that provide for realistic targets based on economic considerations.

With that philosophy in mind, the Task Force also recognized that if private investments could return a profit on infrastructure development, investments would already have been made in rural broadband infrastructure. But because of Alaska's remote landscape and diffused population, a profitable return has been and will continue to be challenging.

Background: The Task Force identified three approaches as it began to review cost calculations:

1. Conventional engineering based on estimating the coverage requirements imposed by the goal and then using those estimates to project the necessary investment to fulfill the goal. This is the methodology followed for the investment estimation of Australia's National Broadband Plan.
2. The "top down approach" based on first determining the amount of financial resources needed and then sizing the amount of coverage that will be achieved given those resources. To some degree, this is the approach that has been followed in the United States with the Broadband Technology Opportunities Program.
3. The "public policy" framework, which defines targets, such as coverage and speeds, but leaves the amount of investment required unaddressed. The objective would not be to provide extremely precise estimates but to gauge the investment in broadband required in order to have a sense of the resultant social and economic returns.

Ultimately, the Task Force adopted the "public policy" framework, focusing its recommendations to meet the target of 100 Mbps (up and down) to every Alaska household by 2020 while utilizing current, conventional engineering methodologies to gauge the investment required for purposes of informing the development of those recommendations. Cost estimates were averaged across the entire state. The Task Force found that whether delivered by fiber, microwave, or satellite (or a combination) the cost to build out the required infrastructure would be in excess of $1 billion.

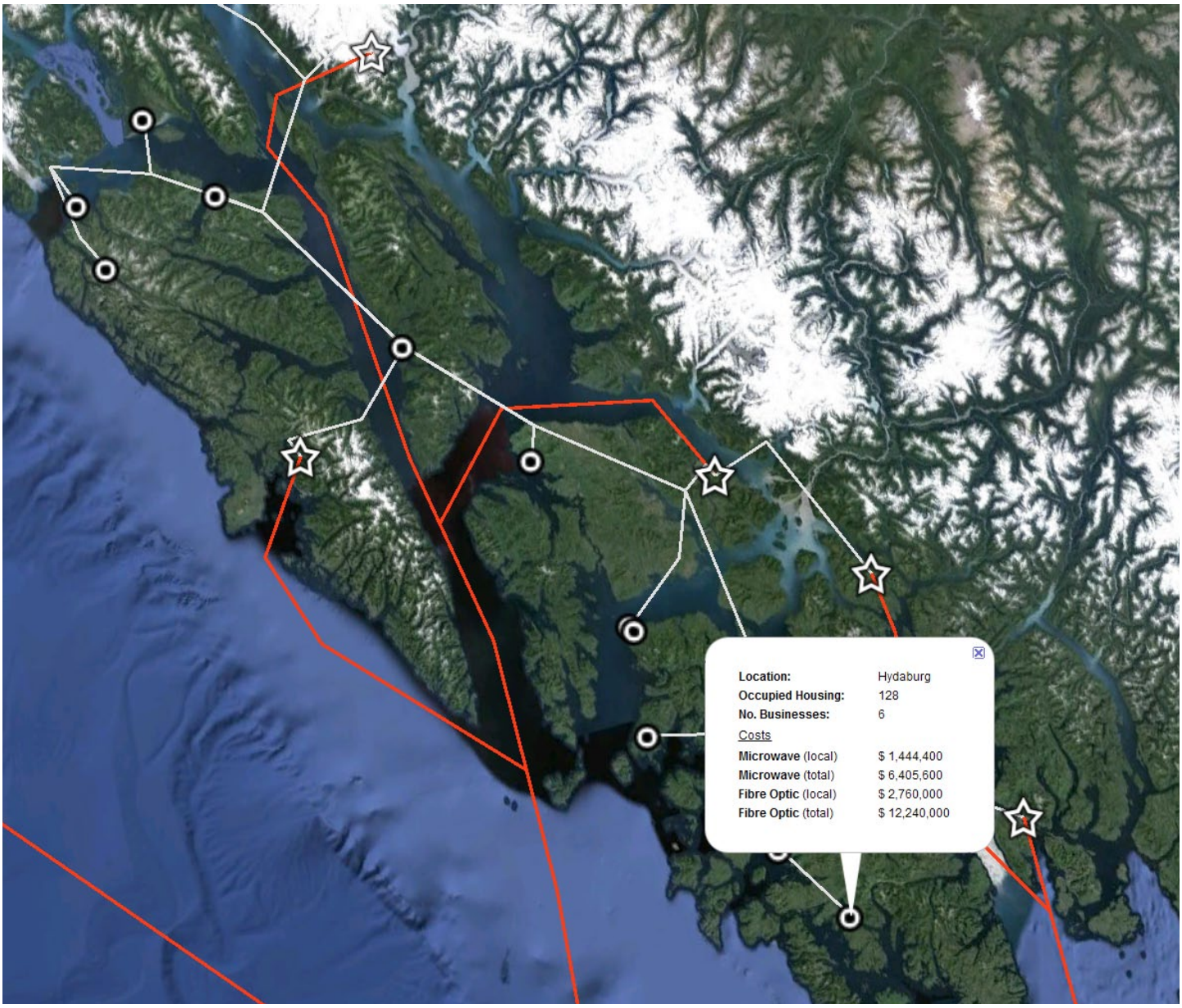
Estimated Total Investment Required to Achieve Goal for 2020	
Middle Mile New Construction (fiber & microwave)	$610 million
Add to Existing Microwave System	$30 million
Last Mile (all state households/businesses)	$580 million
Total	$1.2 billion
Additional Alaskans with High Speed Fiber Access	80,000
Additional Alaskans with High Speed Microwave Access	20,000

Every individual segment of the network will have actual costs reflective of the terrain and other environmental characteristics and can vary widely from unit costs derived from these universal estimates.

While agreeing that private sector investment should be the primary funding of broadband development, the Task Force also considered that, to date, private sector investment has been in areas where demand and demographic density would generate an appropriate rate of return on investment. Over time there will be additional broadband facilities constructed by Alaska's telecommunications companies either based solely on market opportunity or with anecdotal economic incentive from any number of sources. The Task Force recognized, however, that there will remain a number of locations for which significant economic support or subsidy will be required to allow for construction and operation of the broadband facilities needed to meet the Task Force objective. For that reason, telecommunications infrastructure should be an important part of major construction projects.

Example: Delivering High Speed to Hydaburg

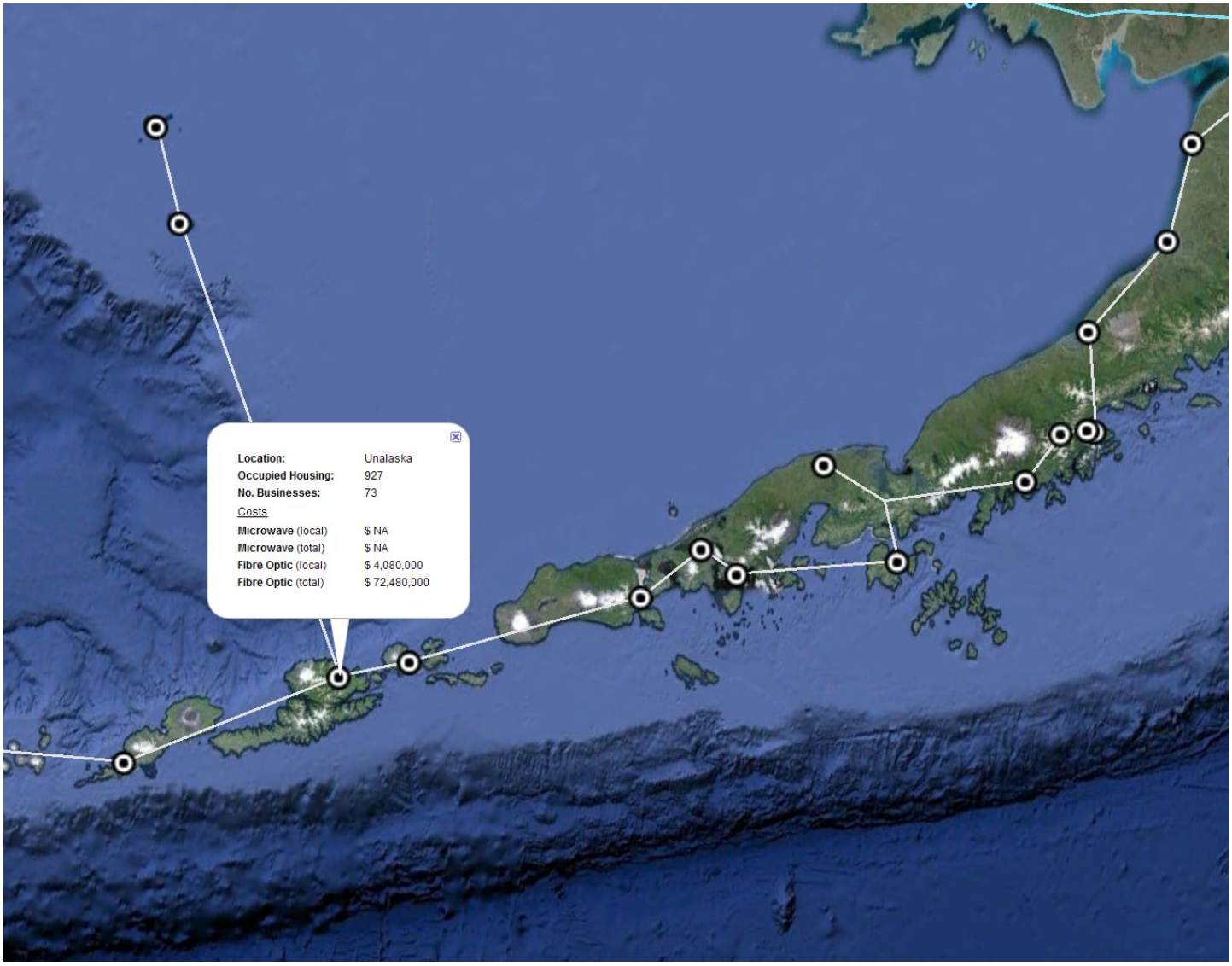
According to the estimates developed by SNAP, the cost of delivering 100 Mbps of broadband speed by fiber to Hydaburg – 128 households and 6 businesses – would be $12.24 million.



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

Example: Delivering High Speed to Unalaska

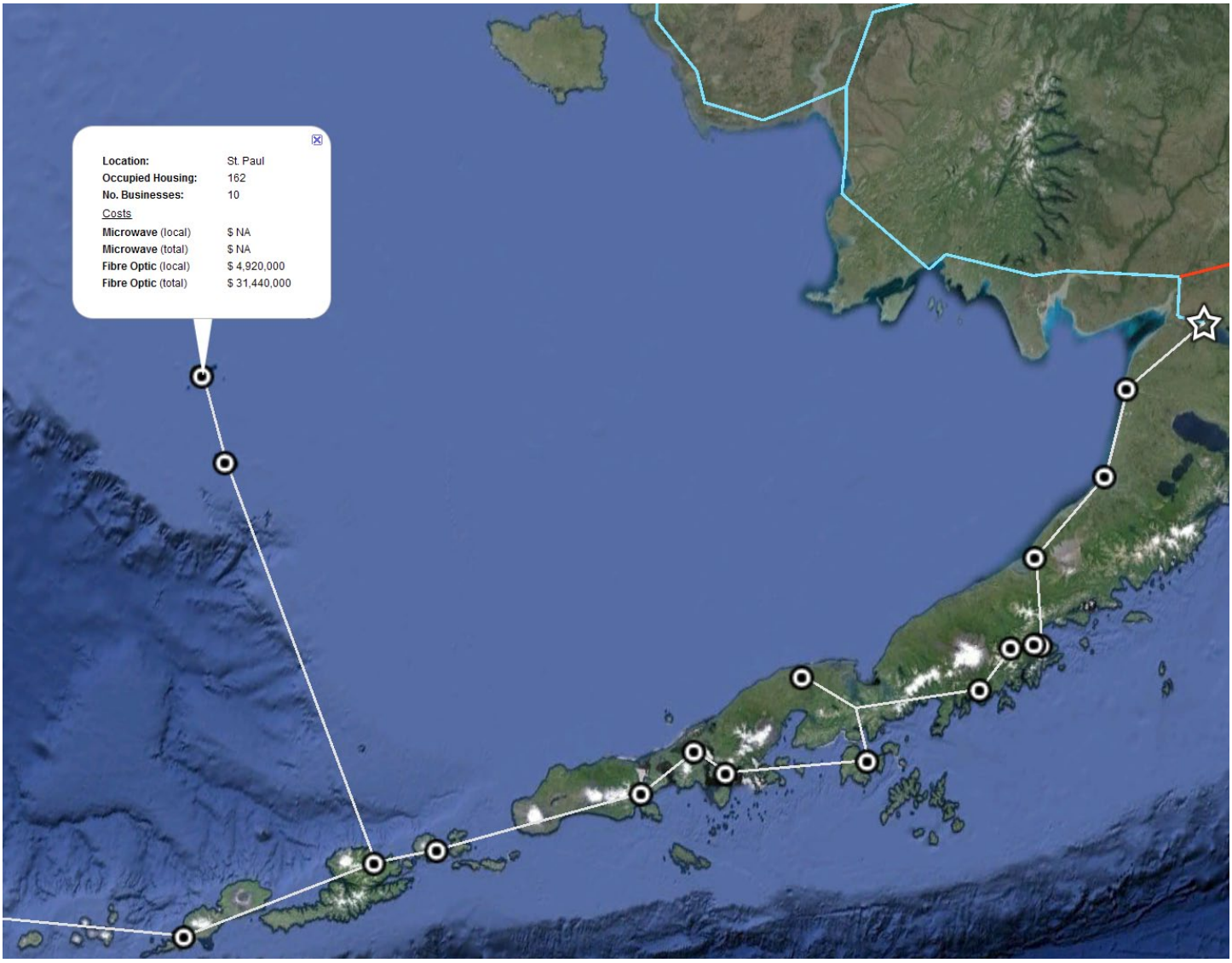
According to the estimates developed by SNAP, the cost of delivering 100 Mbps of broadband speed by fiber to Unalaska – 927 households and 73 businesses – would be $72.4 million.



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

Example: Delivering High Speed to the Pribilof Islands

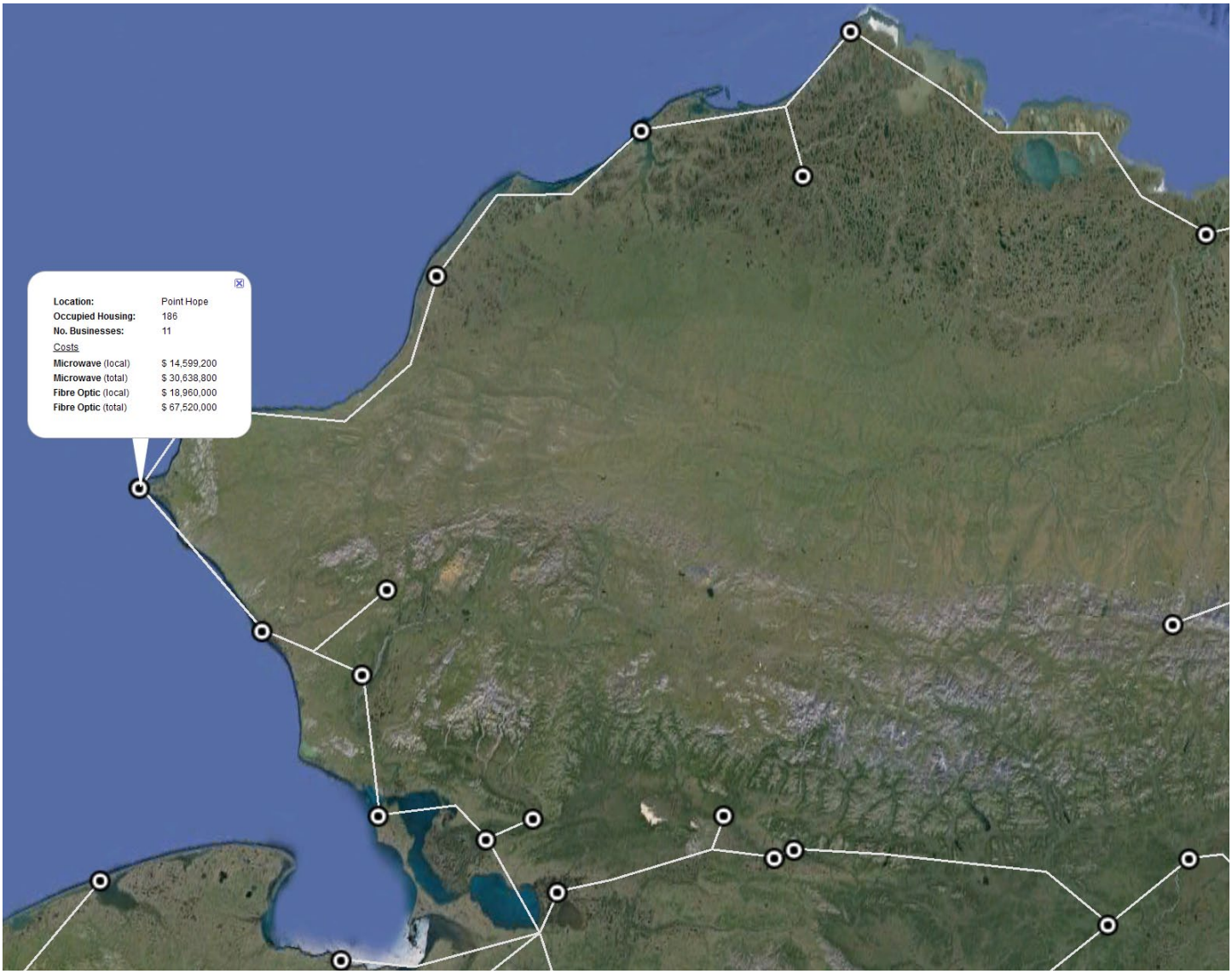
According to the estimates developed by SNAP, the cost of delivering 100 Mbps of broadband speed by fiber to the Pribilofs – 162 households and 10 businesses – would be $31.4 million from Dutch Harbor.



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

Example: Delivering High Speed to Point Hope

According to the estimates developed by SNAP, the cost of delivering 100 Mbps of broadband speed by fiber to Point Hope – 186 households and 11 businesses – would be $67.5 million.



Broadband infrastructure cost model provided by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks. 2012

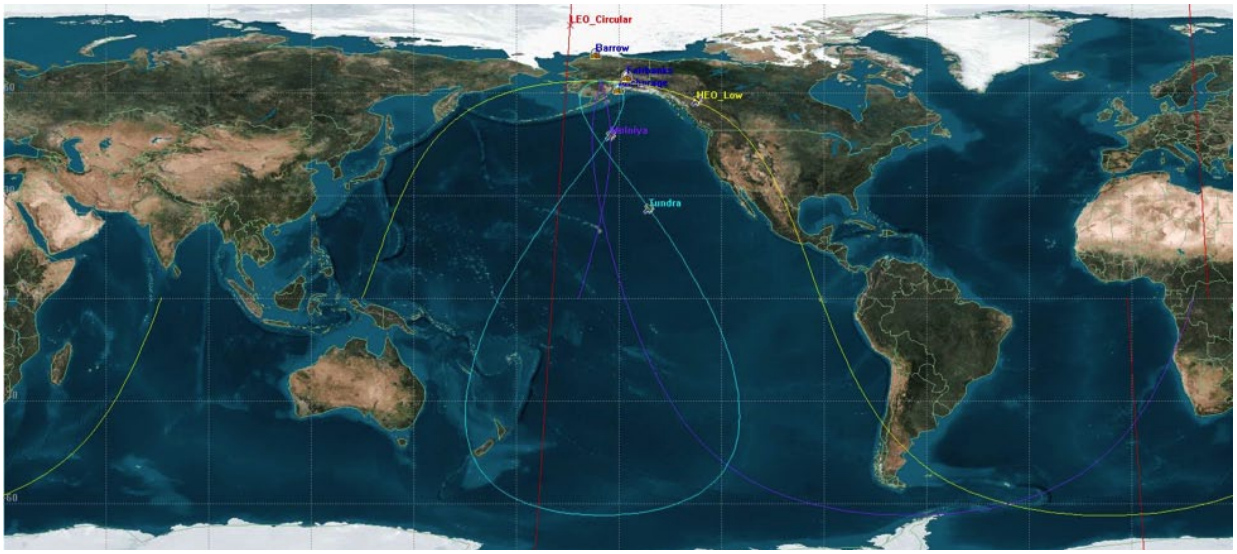
Federal Universal Service Funding

Created in 1997, the FCC's Universal Service Fund (USF) system has played perhaps the biggest role to date in funding the development of telecommunications and broadband systems/infrastructure throughout Alaska. In 2010 alone, the USF contributed more than $300 million to the state in the form of subsidies for rural health care communications, network deployment in high-cost areas of the state, subsidies to connect schools and libraries, and discounts for basic telephone service for low-income households.

In 2010, the FCC published the National Broadband Plan to fulfill its directive under the American Recovery and Reinvestment Act of 2009 (ARRA). The National Broadband Plan called for a number of initiatives to improve broadband across the United States, including reforming the entire USF system: the first major USF reform since the program was established under the Telecommunications Act of 1996. Toward that end, the FCC issued the USF Reform Order in November 2011, which put in place a process to transition the USF program from a focus on traditional voice telephone service to one that focuses on broadband development (wireless and wireline).

For Alaska, the most significant program change has been the creation of three new universal service funding mechanisms (the Connect America Fund, the Mobility Fund, and the Remote Areas Fund) to gradually replace the old system that distributed funds under the high-cost section of the program. In addition to replacing existing federal universal service support mechanisms, the new funding mechanisms are now designed to extend and maintain broadband service to the "unserved" portions of the state where only slow, or even no, broadband access is available. The new funds will provide federal support to wire line, wireless, and satellite providers based on a combination of changes to legacy procedures, cost models, and reverse auctions. The new funds all have the slight potential to benefit certain parts of Alaska. However, there is a tradeoff: subsidies slated for these programs are limited and are likely to decline for Alaska in the coming years.

Other portions of the USF program are still under review, but the overall effect is that Alaska recipients of federal USF support are facing increased service obligations while enduring significant decreases to federal USF support levels under the current FCC reform measures. This uncertainty has had a chilling effect on some investment options in Alaska communications infrastructure. The Task Force agrees that funds dedicated to Alaska should not be diverted and that Alaska and its telecommunications industry should continue advocating Alaska's position on the FCC's reform measures by stressing Alaska's unique characteristics in terms of both demographics/ geography (with no comprehensive road system and rural areas characterized by small population centers dispersed across vast geographical expanses) and infrastructure (with no statewide terrestrial communications network). These dynamics should continue to be cited as justification for additional federal USF support to allow expansion of broadband services throughout Alaska and, at the very least, demonstrate that existing funds for Alaska should not be diverted to other locations.[56]



How Do We Pay for It? Funding Options

State of Alaska Funding

As the state considers the cost of developing a broadband network in Alaska, it must be underscored that the deployment and maintenance of broadband infrastructure will be costly and largely uneconomical to private enterprise due to the sparse population, vast land expanse, lack of a comprehensive road system, limited construction seasons, and vast imposing topography.[57] The challenge of expanding broadband services throughout Alaska is exacerbated by the fact that federal support (Universal Service Fund) for Alaska service providers is decreasing despite federal expectations that telecommunication companies upgrade voice networks to broadband-capable networks.

In consultation with a wide variety of advisors, the Statewide Broadband Task Force has identified the following possible options for state funding of broadband Internet infrastructure and services.

Grant Programs:

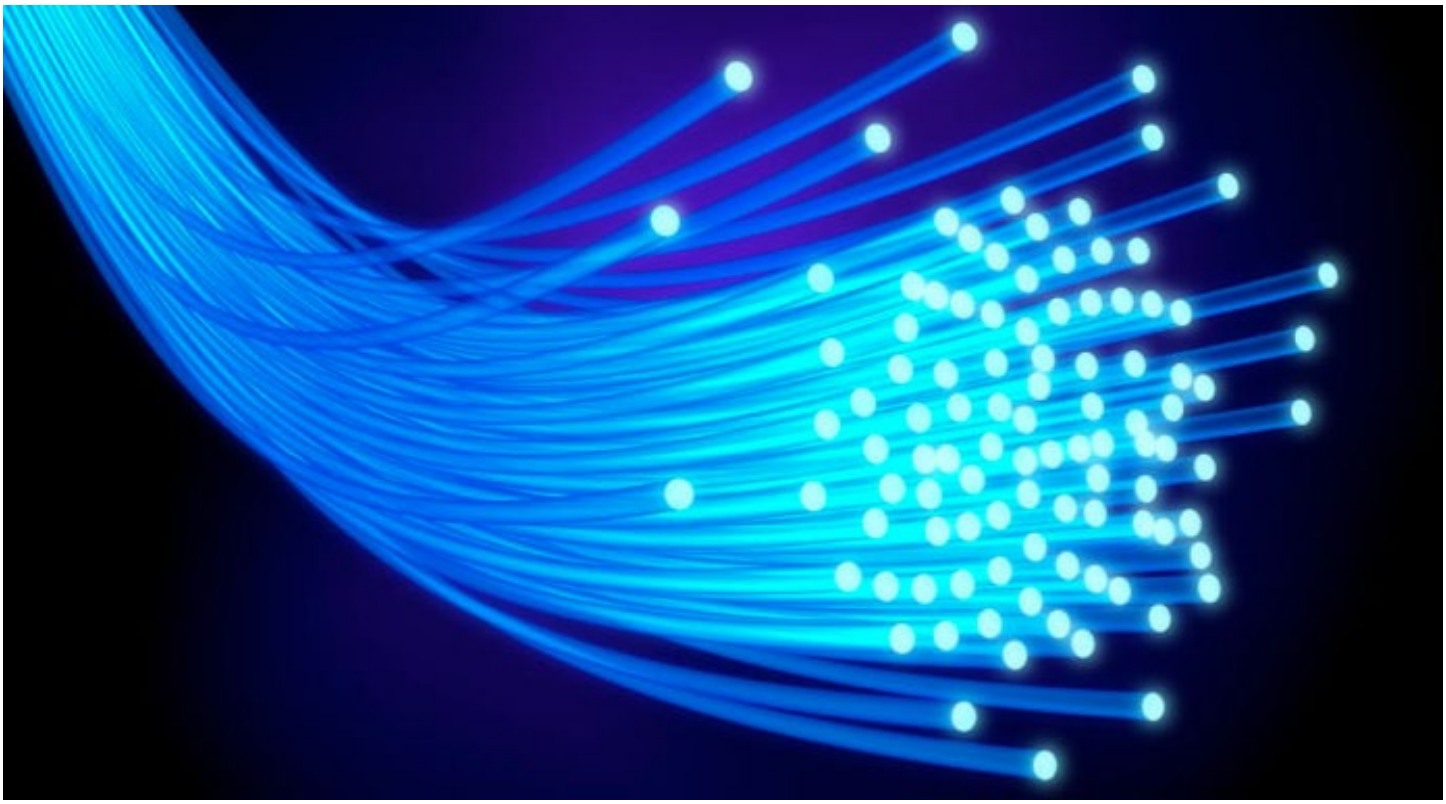
- Beginning in FY 2015, include in its annual budget a matching grant program for proposed broadband infrastructure projects. These projects must:
  - ◊ Have at least a 50 percent match from other sources of funding;
  - ◊ Meet the Task Force goal of 100 Mbps (up and down) for broadband service; and,
  - ◊ Not duplicate existing broadband infrastructure.
- Explore the creation of a state broadband equalization subsidy between urban and rural rates so that both are comparable in price and service level. Rural areas with broadband service comparable to that of urban areas (price and service) would not be eligible. This program could be patterned after the Power Cost Equalization (PCE) program, which is a state-funded program.[58]
- Consider creating a competitive state grant for organizations that provide training for digital literacy, workforce development, and broadband adoption.
- Create a state grant to reduce the local contribution required from eligible schools and libraries participating in the E-Rate program.[59]
  - ◊ The grant could match the community e-Rate contribution, and/or create a state-based program to provide funding for universities and tribally-owned colleges.

Loan Programs:

- The State could consider ways to promote further deployment of broadly delivered broadband infrastructure:
  - ◊ Establish a broadband financing program within AIDEA to be capitalized with a one-time $250 million legislative appropriation and administered consistent with Task Force principles. This might require amending the definitional section of the agency's statutes to add the term "broadband infrastructure project." As such, the fund would be separate from AIDEA's existing revolving fund and would establish a new loan program through which AIDEA could make loans, offer loan guarantees for broadband-related middle and last-mile needs, or take an ownership position in broadband infrastructure.
    - » For example, through AIDEA, the state could consider anchor tenancy, and/or investment in a next generation satellite that could provide interim speeds of at least 100 Mbps to all regions of Alaska. If a state-supported investment was made in a satellite, management of the satellite capacity and wholesale Internet services to retail broadband providers and anchor institutions would be contracted through a competitive bid process.

Permitting & Assessments:

- Require that infrastructure projects such as roads, ports, railroads, pipelines, and mines financed with state appropriations include broadband build out as part of the project budget. This could be via bringing a telecommunications provider into the public-private partnership arrangement, or via a mandatory percentage for development of broadband infrastructure (similar to 1 percent for art requirements) or a budget not based on a percentage, but on actual costs. Reverse auction or otherwise incent the laying of high speed fiber and utilities at the same time these major infrastructure projects are developed.
- Streamline permitting for access across state land and work to coordinate the permitting process across federal and Native-owned land.
- Examine the Alaska Universal Service Fund to determine if revisions to the fund are necessary, including ensuring statutory authority for funding broadband services.



Next Steps

It is the Task Force's fervent hope that this plan does not languish, but becomes a living document that helps guide stakeholders and policymakers as they engage in conversation, consider future broadband development, and make decisions. With that in mind, and to generate further action, we offer the following action items.

- The Task Force shall publicize and seek public comment on the plan in multiple venues including a website, presentations at stakeholder conferences and meetings, and testimony to appropriate legislative committees.
- Establish an Office of Broadband Policy within state government to manage the statewide plan, promote future policy, and market the importance of broadband adoption. Without such an office, the plan languishes.
- The Governor and legislature should review the plan before the next legislative session and consider possible legislation to enact recommendations and funding options that are appropriate at this time.

Conclusion

We have reached a point in the development of modern communications wherein the Internet is firmly woven into our fabric of everyday life. America is in a race to the top in order to compete in the globalization of trade and development. In Australia, the government is investing $43 billion over eight years through its National Broadband Network to bring an advanced, fast, and reliable Internet backbone to the entire country that will include 12 Mbps at a minimum to the most rural and remote regions of the country. In Sweden, the government has endorsed a National Broadband Strategy (2009) and committed $34.9 million in public funds to deliver minimum speeds of 100 Mbps to 40 percent of households and businesses by 2015, and to 90 percent of households and businesses by 2020. The French government will spend $27 billion over the next 10 years to bring high speed broadband to the entire country, although exact speeds have not been committed. Meanwhile, the United States, through the FCC, is spending $4.3 billion for broadband deployment and support for rural and remote regions of the country to affect efficient and reliable communication systems. These are signs that the rest of the world is making the investments to ensure their citizens' basic needs are met.



Alaska is part of this race. The same factors that make broadband deployment difficult in Alaska—geographic remoteness, lack of roads, high costs—also mean that Alaska, more so than other states, has the most to gain from making sure that affordable and reliable high-speed broadband is available to all its residents. Very soon, social pressure will be too great for government and civil society not to act, whether collaboratively or alone. A clear plan is in the best interest of the state.

End Notes

1 State Broadband Index, http://www.technet.org/technet-state-by-state-broadband-report/.

2 The Information Technology and Innovation Foundation, www.itif.org.

3 National Broadband Plan, http://www.broadband.gov/plan/2-goals-for-a-high-performance-america/.

4 National Broadband Map, http://www.broadbandmap.gov/rank/all/state/percent-population/within-nation/speed-download-greater-than-100mbps/ascending.

5 Federal Communication Commissions, June 2012, http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0614/DOC-314630A1.pdf.

6 Recovery Act, http://www.recovery.gov/Transparency/RecipientReportedData/pages/RecipientProjectSummary508.aspx?AwardIdSur=104253 or http://www.connectednation.org/BlogPost/alaska%E2%80%99s-statewide-broadband-access-growing.

7 Calculated based on findings from Crandall, Littan, and Lehr (Robert W. Crandall, Robert E. Litan, and William Lehr, "The Effects of Broadband Deployment on Output and Employment: A Cross-Sectional Analysis of U.S. Data," Issues in Economic Policy: The Brookings Institution, No. 6, July 2007, p. 2. For a two-year time frame, this regression generated .593 as the coefficient for the impact of broadband expansion on employment. As such, this growth is calculated based on a .2965 (.593/2) annual coefficient. According to the United States Bureau of Labor Statistics, Alaska's employment was 318,700 for May 2012.

8 Based on a mean annual income of $52,050 in Alaska (Source: United States Bureau of Labor Statistics, May 2012).

9 Based on an average savings of $217 by 35% of home broadband users (source: "The Economic Impact of Stimulating Broadband Nationally," a report by Connected Nation available here: http://www.connectednation.org/_documents/connected_nation_eis_study_executive_summary_02212008.pdf).

10 Based on 66% of home broadband users driving an average of 102 fewer miles per month because of their online activities (source: "The Economic Impact of Stimulating Broadband Nationally," a report by Connected Nation available here: http://www.connectednation.org/_documents/connected_nation_eis_study_executive_summary_02212008.pdf), valued at $0.585 per mile, the General Services Administration reimbursement rate (http://www.gsa.gov/graphics/ogp/FTR_Amend_2008_05_Order.pdf). This calculation only factors in the 76.6% of new broadband users who would be age 16 or older, based on the 2007-2011 average ACS population distribution for the state of Alaska (US Census, 2007-2011 American Community Survey 5-Year Estimates).

11. Based on the average broadband user saving 15 hours per month by conducting transactions online (source: "The Economic Impact of Stimulating Broadband Nationally," a report by Connected Nation available here: http://www.connectednation.org/_documents/connected_nation_eis_study_executive_summary_02212008.pdf), valued at $12.51 per hour, one-half of the average hourly wage for Alaska (Source: United States Bureau of Labor Statistics, May 2012).

12 Ibid.

13 Based on 66% of home broadband users driving an average of 102 fewer miles per month because of their online activities (source: "The Economic Impact of Stimulating Broadband Nationally," a report by Connected Nation available here: http://www.connectednation.org/_documents/connected_nation_eis_study_executive_summary_02212008.pdf), with an average estimated fuel fleet economy of 25.67 per gallon (Source: US Highway Transportation Board), and each gallon of gasoline producing 19.4 lbs. of CO2 gas (Source: United States Environmental Protection Agency). This calculation only factors in the 76.6% of new broadband users who would be age 16 or older, based on the 2007-2011 average ACS population distribution for the state of Alaska (Source: US Census, 2007-2011 American Community Survey 5-Year Estimates).

14 Calculations based on the average value of $13.41 per ton for the carbon emission offsets charged by major U.S. carbon offset providers, as reported by Carbon Catalog (www.carboncontrol.org).

15 University of Alaska Anchorage, http://www.iser.uaa.alaska.edu/Publications/2012_11-TERRA.pdf.

16 **E-Rate** refers to the Universal Service Fund Schools and Libraries Program and provides discounts of up to 90 percent to help most schools and libraries in the United States obtain affordable telecommunications and Internet access. (http://www.usac.org/sl/about/getting-started/default.aspx).

17 **Last Mile** refers to the broadband connection between your home or wireless device and your broadband service provider. (http://blog.broadband.gov/?entryId=10657).

18 **Latency** is the time it takes for a packet of data to travel from one designated point to another in a network, commonly expressed in terms of milliseconds. (http://www.fcc.gov/measuring-broadband-america/2012/july).

19 **Adoption** means the choice to acquire and use a new invention or innovation; in this case Broadband Internet (http://elsa.berkeley.edu/~bhhall/papers/HallKhan03%20diffusion.pdf).

20 **Reliability** is an attribute of any computer-related component (software, or hardware, or a network, for example) that consistently performs according to its specifications. (http://whatis.techtarget.com/definition/reliability).

21 **Polar Fiber** is a reference to undersea fiber optic cable routes through the Arctic Ocean. At least three companies have outlined the project so far: Arctic Fibre from Canada, Polarnet from Russia, and the Arctic Link proposal from Alaska. (http://www.alaskadispatch.com/article/arctic-fiber-cable-proposed-link-asia-and-europe).

22 NTIA, http://www2.ntia.doc.gov/files/broadband-data/Provider%20by%20Speed%20Tier%20JUNE%202011.pdf.

23 Map produced by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks, based on middle-mile infrastructure reported by the Regulatory Commission of Alaska. http://www.alaska.edu/oit/bbtaskforce/geAlaskaBroadbandProject.html.

24 Map provided by AT&T Alascom.

25 University of Alaska Anchorage, http://www.iser.uaa.alaska.edu/Publications/2012_11-TERRA.pdf.

26 *See* World Bank (2009) *Information and Communication for Development: Extending reach and increasing impact*, chapter 3, available at: http://siteresources.worldbank.org/EXTIC4D/Resources/IC4D_Broadband_35_50.pdf.

27 The OECD is an international economic organization of 34 countries founded in 1961 to stimulate economic progress and world trade. http://www.oecd.org/.

28 See Arctic Communications Infrastructure Assessment Report (2011) *A Matter of Survival: Arctic Communications Infrastructure in the 21st Century*, Section 8.3, *Prepared by Imaituk Inc.* available at: http://www.aciareport.ca/resources/acia_full-v1.pdf.

29 Comments submitted April 9, 2009, by the State of Alaska, Office of the Governor, to the NTIA Broadband Technology Opportunities Program in response to the NTIA and USDA Rural Utility Service request for information about the American Recovery and Reinvestment Act of 2009 Broadband Initiatives.

30 See World Bank (2011) *Broadband Strategies Handbook; Table 1.1: Estimated Broadband Employment Creation Multipliers in Various Countries*. http://siteresources.worldbank.org/INFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/2012-02-ICTPolicyNotes.pdf.

31 Job creation is a part of some states' and countries' broadband plans. For example, according to Information & Communication Technologies, the national broadband plan for Australia, Germany, Ireland, Korea, Spain, and the U.S. all include projections of job creation through broadband infrastructure deployment/ network construction.

In Alaska today, physicians, clinics, and hospitals are in various stages of acquisition, implementation, and adoption of electronic medical records. Organizations such as the Alaska e-health Network (www.ak-ehealth.org) exist to provide services from electronic medical record readiness, vendor selection, and provider workflow/ design to implementation, training, and IT Services.

Broadband functionality is mandatory for the effective use of EMRs. If the clinical workflow is hindered rather than supported by high performance, both physician clinical focus and productivity are impeded as well as overall health care delivery to the patient and their families. Providing patient-specific information at the point of care regardless of the geographic location of the patient or the provider is evolving towards a standard expectation rather than an exception. And, while Health Information Exchange is not widely used, certainly approved physician access to portals within at least some EMRs in productive use at hospitals and clinics is providing real-time patient information to providers across the care continuum.

32 See Connect Alaska (2011) *Business Technology Assessment*, available at: http://www.connectak.org/sites/default/files/connected-nation/Alaska/files/ak_biz_2012.pdf.

33 Federal Communications Commission, www.broadband.gov, Accessed 6/24/11.

34 National broadband plan, http://www.broadband.gov/plan/13-economic-opportunity/.

35 American Library Association, http://www.ala.org/news/mediapresscenter/presscenter/onlinemessagebook/nlw_talkingpoints.

36 Career Change Challenge, http://careerchangechallenge.com/50-job-search-statistics-you-need-to-know/.

37 Richard Florida (2005) *Cities and the Creative Class Cities*. Routledge.

38 This is a sample list of technology startups provided by the Anchorage Economic Development Council and the University of Alaska, Fairbanks.

39 Smarter Balanced Assessment Consortium (2012). *The Smarter Balanced Technology Strategy Framework and System Requirements Specifications*. Available at: http://www.smarterbalanced.org/wordpress/wp-content/uploads/2011/12/Technology-Strategy-Framework_2-6-13.pdf.

40 Association of Alaska School Boards 2011 – 2012. HD6. "iPad for Literacy" project. Summary available at: http://cdl.aasb.org/wp-content/uploads/2013/02/Executive-Summary-HD6-iPad-Project.pdf.

41 Ibid.

42 Davis, 2009; Hoffman, Bertot, and Davis, 2012.

43 Hoffman, Bertot, and Davis, 2012. http://www.ala.org/research/sites/ala.org.research/files/content/initiatives/plftas/2011_2012/plftas12_statetables.pdf.

44 Bill & Melinda Gates Foundation, 2011; Hoffman, Bertot, and Davis, 2012; Lehr, 2010. http://www.ala.org/research/sites/ala.org.research/files/content/initiatives/plftas/2011_2012/plftas12_statetables.pdf.

45 American College of Physicians, http://annals.org/article.aspx?articleid=1033220.

46 Alaska land mobile radio, http://alaskalandmobileradio.org/.

47 Current ALMR Users State of Alaska (Public Safety/Troopers, Natural Resources, Administration (ETS), Military & Veterans Affairs (DMVA), Environmental Conservation, Transportation & Public Facilities, Corrections, Alaska Railroad Corporation). Subtotal = 4,723.

Local Municipalities & NGOs (Anchorage = 2,664, Other municipalities and NGOs = 2,963). Subtotal = 6,414.

Department of Defense (DOD), Federal Non-DOD, FAA, FBI, Immigrations & Customs Enforcement, IRS, National Park Service, NOAA - Fisheries Enforcement, Alcohol Tobacco & Firearms, Department of Justice (DEA), Bureau of Land Management, U.S. Customs, U.S. Marshals, U.S. Fish & Wildlife Service. Subtotal = 724.

Total = 17,488.

48 Executive Office of the President. National Science and Technology Council (2013). *Arctic Research Plan FY2013-2017*. Available at: http://www.whitehouse.gov/sites/default/files/microsites/ostp/2013_arctic_research_plan.pdf.

49 Quintillion Networks, http://quintillionnetworks.com/network.php.

50 PolarNet, http://www.polarnetproject.ru/press/20120117-future-en.html.

51 Broadband infrastructure mapping model produced by the Scenarios Network for Alaska and Arctic Planning, University of Alaska, Fairbanks, under a sub-award grant from the NTIA State Broadband Initiative in 2012.

52 See http://www.alaska.edu/oit/bbtaskforce/meetings.html# to download SNAP's broadband scenario map as a KML file that can be viewed via the Google Earth application.

53 "Next generation satellites refers to the latest generation of geostationary broadband satellites operating in the Ka band frequencies (approximately 20 Ghz to 30 Ghz).

54 Federal Communication Commissions, Feb 2013, http://apps.fcc.gov/ecfs/document/view?id=7022121914.

55 Federal Communications Commission (2010). *Connecting America: The National Broadband Plan*. Chapter 2. Goal #1. Available at: http://download.broadband.gov/plan/national-broadband-plan-chapter-2-goals-for-high-performance-america.pdf.

56 On July 26, 2013, the Federal Communications Commission adopted an order that suspends parts of its USF High Cost Fund reform order that deal with rate-of-return carriers in Alaska, in effect stopping cuts to subsidies those carriers now receive for a period of nearly two years. http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0726/DA-13-1656A1.pdf.

57 Anticipated service revenues are limited in many areas due to low population densities and household income levels below national averages. While private investment is necessary to spur broadband infrastructure investment throughout Alaska, public funding mechanisms are also necessary to ensure Alaskan residents receive broadband service at rates and levels approximating those in the continental United States.

58 The PCE is designed to equalize power cost per kilowatt-hour statewide, with a target cost approximating the average cost per kilowatt hour paid by customers in Anchorage, Fairbanks, and Juneau. The PCE program provides economic assistance payments to eligible electric utilities based on electric sales to community facilities and residential customers, with the service provider required to reduce the effective rate per kWh for usage up to 500 kWh per month per customer.

59 The federal government E-Rate program provides subsidies for Internet access, telecommunications services, internal infrastructure, and basic maintenance of internal connections to schools and libraries. The subsidies pay a percentage of costs based on need, with rural and low-income schools receiving the greatest subsidy. This support goes to service providers that provide discounts from 20 – 90 percent based on the level of poverty and the urban/rural status of the population served.

Appendix A: Glossary of Broadband Terms

ADSL - Asymmetric Digital Subscriber Line is a type of DSL that works by splitting your existing telephone line signal into two; one for voice and the other for data. (http://www.ecs-computers.com.au/downloads/ADSLQuickGuide.pdf).

Alaska OWL Project - A grant-funded initiative designed to increase the technology capabilities and connectivity of public libraries throughout Alaska. (http://library.alaska.gov/dev/owl.html).

American Recovery and Reinvestment Act of 2009: In February of 2009, U.S. Congress passed this $787 billion economic stimulus package signed by President Barack Obama that entails creating new jobs and saving existing ones, spurring economic activity, and investing in long-term growth while fostering unprecedented levels of accountability and transparency in government spending. (http://www.recovery.gov/About/Pages/The_Act.aspx).

Arctic Communications Infrastructure Assessment - The Arctic Communications Infrastructure Assessment (ACIA) identifies the issues and challenges facing governments and service providers in ensuring the Canadian Arctic are properly connected for the benefit of Arctic citizens and all Canadians. (www.aciareport.ca).

Bandwidth - Bandwidth refers to the amount of data that can be transferred during a second, usually expressed in bits per second. (http://www.dslreports.com/faq/694).

BIP (Broadband Initiatives Program) - BIP funding for loans, grants, and loan/grant combinations will assist with addressing the challenge of rapidly expanding the access and quality of broadband services across rural America and to meet the objectives of the Recovery Act. (http://www.rurdev.usda.gov/utp_bip.html).

Broadband - Broadband commonly refers to high-speed Internet access that is always on and faster than the traditional dial-up access. (http://www.broadband.gov/about_broadband.html).

Broadband Adoption - Adoption means the choice to acquire and use a new invention or innovation; in this case broadband Internet. (http://elsa.berkeley.edu/~bhhall/papers/HallKhan03%20diffusion.pdf).

BTOP (Broadband Technology Opportunities Program) - A $4.7 billion program grant administered by the NTIA to support the deployment of broadband infrastructure in unserved and underserved areas, to establish new public computer centers with broadband access, and to sustain broadband adoption. (http://www2.ntia.doc.gov/about).

Community Anchor Institutions - Community Anchor Institutions (CAI) include schools, libraries, medical and health care providers, public safety entities, colleges and other institutions of higher education, and other community support organizations and entities. (http://www.broadbandmap.gov/source/maps#community-anchor-institutions).

DCCED - Alaska Department of Commerce, Community and Economic Development promotes a healthy economy, strong communities, and protection of consumers in Alaska. (http://www.commerce.state.ak.us/).

Deployment – Process of distributing the technology (installing, setting up, and running) available for use; in this case making broadband available for all residents. (http://www.pcmag.com/encyclopedia/term/41136/deployment).

Digital Sandbox - Alaska's Digital Sandbox (www.alaskadigitalsandbox.org) is open to the public; however contributors must request and be approved by EED. This digital repository is a place educators can access, upload, download, and share resources 24/7, as well as receive constructive feedback from content experts on how to improve the resource for quality and usefulness.

Download - It is a process of moving files from the web source to your computer with Internet access. (http://www.moneysupermarket.com/broadband/glossary/).

Downstream - Data that goes from the Internet to your computer such as emails, website, etc. that are downloaded from the Internet. (http://www.moneysupermarket.com/broadband/glossary/).

E-Government - The Office of E-Government and Information Technology (E-Gov), headed by the Federal Government's Chief Information Officer (CIO), develops and provides direction in the use of Internet-based technologies to make it easier for citizens and businesses to interact with the federal government, save taxpayer dollars, and streamline citizen participation. (http://www.whitehouse.gov/omb/e-gov).

E-Learning - Online learning has various definitions, but an essential component for all is the use of computing and telecommunication technologies to deliver and receive course materials. (https://www.excelsior.edu/web/student-online-success-guide/online-learning).

Electronic Health/Medical Records – A digital health care infrastructure that encompasses and leverages digital progress and can transform the way care is delivered and compensated. With EHRs, information is available whenever and wherever it is needed. (http://www.healthit.gov/providers-professionals/benefits-electronic-health-records-ehrs).

Federal Communication Commission - The Federal Communications Commission regulates interstate and international communications by radio, television, wire, satellite, and cable in all 50 states, the District of Columbia, and U.S. territories. It was established by the Communications Act of 1934 and operates as an independent U.S. government agency overseen by Congress. (www.fcc.gov).

First Net - The Middle Class Tax Relief and Job Creation Act of 2012 created the First Responder Network Authority as an independent authority within NTIA, to provide emergency responders with the first high-speed, nationwide network dedicated to public safety. (http://www.ntia.doc.gov/category/firstnet).

FTTH (Fiber to the Home) - FTTH refers to the use of fiber optic cables to carry digital information directly to homes and businesses. FTTH replaces our copper and coaxial cables that had previously been installed in our service areas. (http://www.southslope.com/about-us/fiber).

ISER – University of Alaska Institute of Social and Economic Research works to enhance the well-being of all Alaskans through non-partisan research that helps people understand social and economic systems in order to support informed public and private decision making. (http://www.iser.uaa.alaska.edu/).

Last Mile - Last Mile refers to the broadband connection between your home or wireless device and your broadband service provider. (http://blog.broadband.gov/?entryId=10657).

Latency - Latency is the time it takes for a packet of data to travel from one designated point to another in a network, commonly expressed in terms of milliseconds. (http://www.fcc.gov/measuring-broadband-america/2012/july).

LTE Mobile Broadband Service – The long term evolution is the last step toward the 4th generation of radio technologies designed to support wireless Internet access via cellphones or any handheld devices. (http://innovation.verizon.com/content/dam/vic/portals/95/docs/LTE%20The%20Future%20of%20Mobile%20Broadband%20Technology.pdf).

Megabits or Kilobits – The connection speed of broadband usually denoted by Mbps or Kbps. (https://support.speedtest.net/entries/21057567-What-do-mbps-and-kbps-mean-).

Microwave – The term refers to electromagnetic energy having a frequency higher than 1 gigahertz (billions of cycles per second), corresponding to wavelength shorter than 30 centimeters. Microwave transmission technology is commonly used in terrestrial telecommunications. (http://searchnetworking.techtarget.com/definition/microwave).

Middle Mile - The connections between your broadband service provider and the Internet. (http://blog.broadband.gov/?entryId=10657).

Mobile broadband – Mobile broadband is called wireless wide area network (WWAN) technology; provides wireless high-speed Internet access through portable devices. (www.windows.microsoft.com/en-us/windows7/what-is-mobile-broadband).

National Broadband Plan - The National Broadband Plan sets out a roadmap for initiatives to stimulate economic growth, spur job creation, and boost America's capabilities in education, health care, homeland security, and more. The plan includes sections focusing on economic opportunity, education, health care, energy and the environment, government performance, civic engagement, and public safety. (http://www.broadband.gov/plan/).

NTIA - The National Telecommunications and Information Administration (NTIA), located within the Department of Commerce, is the Executive Branch agency that is principally responsible by law for advising the President on telecommunications and information policy issues. (www.ntia.doc.gov/about).

Organization for Economic Co-operation and Development – OECD provides useful information and promotes policies that will improve the economic and social well-being of people around the world. (http://www.oecd.org/about/).

RCA - The Regulatory Commission of Alaska (RCA) regulates public utilities by certifying qualified providers of public utility and pipeline services and ensuring that they provide safe and adequate services and facilities at just and reasonable rates, terms, and conditions. (http://rca.alaska.gov/RCAWeb/home.aspx).

Russian Optical Transarctic Cable System - Russian firm Polarnet's project that will begin in August 2013 to build this system on laying fiber-optic cables. The cables will span approximately 14,700km through the Northern Sea Route, connecting London to Japan, with various connection branches including to Murmansk and Beijing. (http://polarnetproject.ru/).

Satellite – Satellite broadband is an alternative option for residents that are unavailable to get traditional fixed broadband service such as ADSL. Satellite broadband uses a satellite dish to provide two-way access to broadband services. (http://www.thinkbroadband.com/guide/satellite-broadband.html).

SNAP - Scenario Networks for Alaska and Arctic Planning is located at University of Alaska Fairbanks; works with stakeholders to fill increasing needs for climate information and adaptation planning. (http://www.snap.uaf.edu/).

Social Networking – A web-based service that allows individuals to expand their contacts by making connections through web platform. (http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html).

State Broadband Index – The index uses three categories to develop the state rankings that illuminates the broadband landscape: adoption, network speeds, and economic structure. (http://www.technet.org/wp-content/uploads/2012/12/TechNet_StateBroadband3a.pdf).

Telecommuting – It is a work arrangement that allows employees to work from home instead of commuting to a physical location for work. (http://mashable.com/2013/05/11/telecommuting-infographic-2/).

Telemedicine - Telemedicine seeks to improve a patient's health by permitting two-way, real time interactive communication between the patient, and the physician or practitioner at the distant site. This electronic communication entails the use of interactive telecommunications equipment that includes, at a minimum, audio and video equipment. (http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Delivery-Systems/Telemedicine.html).

TERRA Project - TERRA is GCI's (Alaska based provider) vision to build a next-generation communications network for the remote and rural areas of Alaska. (http://terra.gci.com/).

Universal Service Fund - As mandated by the 1996 act by the FCC, the fund is to ensure all Americans should have access to communications services. (http://transition.fcc.gov/wcb/tapd/universal_service/).

Upload – It is a process of transferring the files from your computer to the web via Internet access. (http://www.moneysupermarket.com/broadband/glossary/).

User Cost – The price that end users pay for broadband service.

Wi-Fi - Wi-Fi is a very popular networking technology that provides high speed Internet and networking connections by using a router which transmits radio waves. (http://networkwire.org/what-is-wifi).

Appendix B: Broadband Fact Sheet

1. ***What is broadband?***

Broadband means providing two-way data transmission with advertised speeds of at least 768 kilobits per second (Kbps) downstream and at least 200 kilobits per second (Kbps) upstream to end users, or providing sufficient capacity in a middle mile project to support the provision of broadband service to end users.

2. ***How does broadband differ from wireless service for your computers or phones?***

Wireless service for your computers or phones uses towers, antennas, and base stations to provide the service. The upstream and downstream speeds are not measured. Broadband can also use wireless technology; however, the upstream and downstream speeds are measurable.

There are two types of broadband wireless technology: 1) fixed wireless broadband service, and 2) mobile wireless broadband service. Fixed wireless technologies use longer range directional equipment which can provide broadband service in remote or sparsely populated areas where other types of broadband would be too costly. Mobile wireless broadband services have a more limited range.

3. ***How many communities have access to broadband?***

There are 126 communities in Alaska that currently have access to the Internet. These communities include technologies ranging from fiber to fixed wireless service. Please see Appendix F for the complete list of the communities and their available technologies.

4. ***Internet usage by community***

According to the State of Alaska Department of Commerce, Community and Economic Development's (DCCED) definition of "rural community," 70% of rural Alaskans subscribe to Internet service, which is lower than the non-rural average of 87%. In addition, 55% of the rural population, as defined by DCCED, subscribe to Internet service at home compared to 78% among non-rural Alaskans.

Please refer to Appendix F for the complete list of communities with Internet usage.

5. ***Average cost for Internet service***

The cost for Internet service varies on the type of service (fiber, satellite, dial-up) and location of the customer (rural versus urban). The overall average price for Internet service is $64.00/month. In rural Alaska, the average price is slightly higher at $71.00/month. Urban Alaska enjoys an average price of $63.00/month.

6. ***On average, the number of buildings in rural communities / villages that are wired***

According to the State of Alaska Department of Commerce, Community and Economic Development, 75% of all rural communities are wired with computers. Of those, 70% have access to the Internet.

Household access to the Internet is a lower percentage in southwest Alaska. This area was researched by the University of Alaska, Institute of Social and Economic Research (UAA – ISER). The ISER study found that the average percentage of Internet access was 66%.[3]

7. ***How does this compare to rural areas in other states?***

Please reference Appendix G for a list of other states and their adoption rates both rural and non-rural. Alaska is also listed for ease of comparison.

8. ***How many satellites serve the state?***

Currently there are nine (9) satellites that provide telecommunication services to the geographical area of Alaska. They are (in order of newest launch first): ViaSat 1 launched October 2011, Galaxy 18 launched May 2008, Galaxy 28 launched June 2005, GE 23 (AMC 23) launched December 2005, AMC 15 launched October 2004, Galaxy 23 launched August 2003, Horizons I (Galaxy 13) launched October 2003, AMC 7 (GE 7) launched September 2000, and Aurora III (AMC 8) launched December 2000.

Iridium and GlobalStar also provide satellite coverage for their satellite phone service. This coverage extends over the geographical area of Alaska.

9. ***What is the National Broadband Plan and how does it impact Alaska?***

The FCC issued the National Broadband Plan (NBP) in March 2010 per the American Recovery and Reinvestment Act of 2009. It is a document encompassing more than 200 recommendations for improving broadband availability, adoption, and utilization, with the goal of making broadband ubiquitous for Americans. The NBP set a national goal of 100 Mbps Internet service within 10 years (the "10 squared" objective).

The NBP states the FCC's goal should be to replace all legacy high cost programs with a new program (the Connect America Fund, or "CAF") that preserves existing broadband connectivity and advances universal broadband. This change in funding strategy can affect Alaska. Please see the "National Broadband Plan" (pages 31 – 33) under the "Future Funding Opportunities Section" for a detailed explanation.

There are additional ways that the NBP affects Alaska. First, it recommends setting aside additional spectrum for mobile broadband. Second, it aims to connect community anchor institutions (CAI) such as schools, hospitals, and government offices with 1 Gbps access. Third, it advocates consumer energy management via broadband. Fourth, it promises an interoperable public safety broadband network.



Appendix C:
Broadband Presentation to the Alaska Broadband Task Force

1. James Hemsath of the Alaska Industrial Development and Export Authority (AIDEA) presented on ways to promote, develop, and advance economic growth and diversification in Alaska in relation to broadband development.
2. Brent Legg of Connect Alaska provided a Business Technology Assessment, which took an in-depth look at broadband use across all sectors of the state's economy.
3. Jeff Ottesen of the State of Alaska Department of Transportation and Public Facilities presented a new research study, the Alaska Deep-Draft Arctic Port Evaluation, which detailed new opportunities in the arctic region due to thawing sea ice and permafrost.
4. The Broadband Availability Gap from the Federal Communications Commission (FCC) was examined.
5. Hugh Short of Alaska Growth Capital presented an overview of the North Slope Borough's proposed Arctic National Broadband Network, which received $4M in state funding toward a terrestrial fiber optic cable link between Barrow and Deadhorse that would be suspended from telephone poles.
6. Carrie Sykes of the Central Council Tlingit and Haida Indian Tribes of Alaska presented the Southeast Alaska Broadband Strategic Plan. The plan stressed broadband is the key to Southeast Alaska's economic future and quality of life for residents.
7. Nate Borson presented the state-funded broadband plan for the City of Gustavus, the purpose of which is to develop a last mile community broadband network that will last 20 years or more, deliver coverage, accommodate growth, and contribute to statewide strategies for bringing broadband service to remote Alaska communities.
8. The California Broadband Task Force report was examined.
9. The Task Force's Technical Committee examined a report on capacity requirements for middle mile broadband deployment.
10. Testimony given before the U.S. Senate Committee on Commerce, Science, and Transportation was reviewed. The document detailed challenges to assessing and improving telecommunications for Native Americans on tribal lands.
11. Chuck Russell of GCI updated the Task Force on GCI's USDA-funded TerraSouthwest fiber-microwave terrestrial broadband infrastructure project in Southwest Alaska.
12. Renee Johnson of the USDA presented an overview of the USDA Rural Utility Service Telecommunications loan and grant programs.
13. Jim Kohler of the Alaska Department of Administration briefed the Task Force on Universal Service Fund reforms impacting broadband development policy in Alaska.
14. A compendium of recent broadband resources with an emphasis on Alaska was examined.
15. Connect Alaska gave a report on federal Universal Service Fund (USF) reform proposals, and discussed ways in which Alaska's telecommunications industry could be affected.
16. A cost estimate and comparison of middle-mile infrastructure development from the Technical Committee was reviewed.
17. An e-learning report was presented by the University of Alaska, which focused on expanding e-learning, while showing a strong correlation between broadband use and success in education.
18. Ethan Berkowitz presented a project briefing on the Arctic Cable Company's plans to link Asia, North America, and Europe by undersea fiber optic cable through the Northwest Passage.
19. Department of Public Safety's Major Matt Leveque updated the Task Force on public safety broadband network planning activities and the Interoperability Communications Committee.
20. A report from the U.S. Government Accountability Office was examined.
21. Dr. Heather Hudson of the University of Alaska Anchorage's Institute for Social and Economic Research (ISER) conducted research on GCI's Terra Southwest broadband network, and its effects on the region. ISER later presented its completed report to the Task Force.
22. The University of Alaska Fairbanks' Scenarios Network for Alaska and Arctic Planning (SNAP) was granted a sub-award

to do research on the economic effects of broadband in Alaska and a potential middle-mile broadband solution for rural Alaska villages. Dr. Keith Cunningham of SNAP later presented the completed report to the Task Force.

23. The Minnesota Broadband Task Force report was examined.
24. Information from the National Public Safety Telecommunications Council was presented in a document that explained what states and locals need to know to prepare for rollout of the Nationwide Public Safety Broadband Network.
25. The North Carolina Broadband Plan was examined.
26. Don Pumphrey from NorthwestTel outlined a proposal for a terrestrial U.S.- Canada fiber optic network that would link the Yukon Territory of Canada with Southeast Alaska.
27. Ed Allen of the Alaska Aerospace Corporation presented the Task Force Technical Committee with a scenario for broadband coverage across Alaska using polar earth-orbiting satellite technology.
28. Matthew J. Desch, CEO, Iridium Communications Inc., presented Iridium's capabilities.
29. Chairman of the Federal Communications Commission Julius Genachowski and Senator Mark Begich met with the Alaska Broadband Task Force and other stakeholders to discuss current reform proposals by the FCC and their effects on Alaska.
30. FCC Commissioner Jessica Rosenworcel joined the Alaska Broadband Task Force with Sen. Mark Begich to hear from the Task Force and user groups about the challenges with current telecomm capacity and economic, social, and health improvement opportunities with improved capacity.
31. Elizabeth Pierce and Hans Roeterink briefed the Task Force Technical Committee on Quintillion Network's plans to tap into Arctic Fibre's under-sea fiber optic cable through the Northwest Passage to bring high-speed broadband to Alaska's northern and western communities.
32. Andy Varner of the Southwest Alaska Municipal Conference (SWAMC) briefed the Task Force on SWAMC's USDA-funded broadband grant to research potential broadband applications that can now be exploited for economic development in Southwest Alaska as a result of United Utilities' new TerraSW terrestrial fiber/microwave project in that region.
33. CEO Glenn Katz of Spacenet, a provider of satellite-based Internet network services as well as hybrid satellite/terrestrial networks and network management services, showcased options for satellite coverage in Alaska using next-generation satellite technology.
34. Two documents, Telecommunications and Information Systems History in Alaska and a Congressional Research Service report to Congress on reforming USF, were reviewed.
35. Dr. Bob Whicker briefed the Task Force on the Association of Alaska School Board's Alaska One-to-One Digital Learning Initiative.

Appendix D: Alaskan Communities With Internet Connectivity

Community	Broadband	Technology 1	Technology 2	Technology 3	Technology 4	Technology 5
KETCHIKAN	Y	FIBER	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS
SAXMAN	Y	FIBER	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS
SOUTH TONGASS	Y	FIBER	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS
THORNE BAY	Y	FIXED WIRELESS	MOBILE WIRELESS			
PETERSBURG-KUPREANOF	Y	CABLE	DSL	MOBILE WIRELESS		
PORT ALEXANDER	Y	MOBILE WIRELESS				
SITKA NO 1	Y	CABLE	DSL	MOBILE WIRELESS		
WRANGELL	Y	CABLE	DSL	MOBILE WIRELESS		
JUNEAU	Y	CABLE	DSL	MOBILE WIRELESS		
ANGOON	Y	CABLE				
CORDOVA	Y	CABLE	DSL	MOBILE WIRELESS		
CRAIG	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
GUSTAVUS	Y	MOBILE WIRELESS				
HAINES	Y	DSL	MOBILE WIRELESS			
HOONAH	Y	MOBILE WIRELESS				
HYDABURG	Y	CABLE	DSL			
KAKE	Y	MOBILE WIRELESS				
KASAAN	Y	FIXED WIRELESS	MOBILE WIRELESS			
KLAWOCK	Y	FIXED WIRELESS				
KLUKWAN	Y	DSL				
METLAKATLA	Y	DSL	MOBILE WIRELESS			

Community	Broadband	Technology 1	Technology 2	Technology 3	Technology 4	Technology 5
SKAGWAY	Y	DSL	MOBILE WIRELESS			
TATITLEK	Y	DSL	MOBILE WIRELESS			
CHISTOCHINA	Y	DSL	MOBILE WIRELESS			
COPPER CENTER	Y	DSL	MOBILE WIRELESS			
DELTANA	Y	DSL	MOBILE WIRELESS			
DOT LAKE	Y	MOBILE WIRELESS				
GAKONA	Y	DSL	MOBILE WIRELESS			
KENNY LAKE	Y	DSL	MOBILE WIRELESS			
MANLEY HOT SPRINGS	Y	MOBILE WIRELESS				
MCGRATH	Y	FIXED WIRELESS				
MENTASTA	Y	DSL	MOBILE WIRELESS			
MINTO	Y	MOBILE WIRELESS				
NENANA	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
NORTHWAY	Y	FIXED WIRELESS				
TANACROSS	Y	DSL	MOBILE WIRELESS			
TETLIN	Y	DSL	MOBILE WIRELESS			
TOK	Y	DSL	MOBILE WIRELESS			
TYONEK	Y	DSL	MOBILE WIRELESS			
FOX	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
TWO RIVERS	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		

Community	Broadband	Technology 1	Technology 2	Technology 3	Technology 4	Technology 5
ANDERSON	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
CANTWELL	Y	DSL				
CLEAR	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
ESTER	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
HEALY	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
FAIRBANKS	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
FORT WAINWRIGHT	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
NORTH POLE	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
BIG DELTA	Y	DSL	MOBILE WIRELESS			
DELTA JUNCTION	Y	DSL	MOBILE WIRELESS			
EIELSON	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
GLENNALLEN	Y	DSL	MOBILE WIRELESS			
MAT SU BOROUGH	Y	DSL	MOBILE WIRELESS			
SALCHA	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
SHEEP MOUNTAIN (in MAT SU)	Y	DSL	MOBILE WIRELESS			
SUTTON	Y	DSL	MOBILE WIRELESS			
VALDEZ	Y	CABLE	DSL	MOBILE WIRELESS		
PALMER	Y	CABLE	DSL	MOBILE WIRELESS		
WASILLA	Y	CABLE	DSL	MOBILE WIRELESS		
BIG LAKE (in MAT-SU)	Y	DSL	MOBILE WIRELESS			

Community	Broadband	Technology 1	Technology 2	Technology 3	Technology 4	Technology 5
HOUSTON	Y	DSL	MOBILE WIRELESS			
KNIK-GOOSE BAY	Y	DSL	MOBILE WIRELESS			
TALKEETNA	Y	DSL	MOBILE WIRELESS			
TRAPPER CREEK	Y	DSL	MOBILE WIRELESS			
WILLOW	Y	DSL	MOBILE WIRELESS			
BUTTE	Y	CABLE	DSL	MOBILE WIRELESS		
CHUGIAK	Y	CABLE	DSL	MOBILE WIRELESS		
EKLUTNA	Y	DSL	MOBILE WIRELESS			
PETERS CREEK	Y	CABLE	DSL	MOBILE WIRELESS		
EAGLE RIVER	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
ELMENDORF	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
FORT RICHARDSON	Y	CABLE	DSL	MOBILE WIRELESS		
ANCHORAGE	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
GIRDWOOD	Y	DSL	MOBILE WIRELESS			
HOPE	Y	DSL	MOBILE WIRELESS			
INDIAN	Y	DSL	MOBILE WIRELESS			
WHITTIER	Y	CABLE	MOBILE WIRELESS			
KENAI	Y	CABLE	DSL	MOBILE WIRELESS		
SOLDOTNA	Y	CABLE	DSL	MOBILE WIRELESS		
FUNNY RIVER	Y	DSL	MOBILE WIRELESS			

Community	Broadband	Technology 1	Technology 2	Technology 3	Technology 4	Technology 5
KASILOF	Y	DSL	MOBILE WIRELESS			
MACKEY LAKE	Y	DSL	MOBILE WIRELESS			
NIKISKI	Y	DSL	MOBILE WIRELESS			
NINILCHIK	Y	DSL	MOBILE WIRELESS			
SALAMATOFF	Y	DSL	MOBILE WIRELESS			
STERLING	Y	DSL	MOBILE WIRELESS			
ANCHOR POINT	Y	CABLE	FIXED WIRELESS	MOBILE WIRELESS		
BEAR CREEK	Y	CABLE	DSL	MOBILE WIRELESS		
COOPER LANDING	Y	DSL	MOBILE WIRELESS			
DIAMOND RIDGE	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
HOMER	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
KACHEMAK BAY	Y	FIXED WIRELESS	MOBILE WIRELESS			
KACHEMAK CITY FRITZ CRK	Y	CABLE	DSL	FIXED WIRELESS	MOBILE WIRELESS	
MOOSE PASS	Y	DSL	MOBILE WIRELESS			
SELDOVIA	Y	DSL	FIXED WIRELESS	MOBILE WIRELESS		
SEWARD	Y	DSL	CABLE	MOBILE WIRELESS		
KODIAK	Y	CABLE	DSL	MOBILE WIRELESS		
OLD HARBOR	Y	DSL				
OUZINKIE	Y	MOBILE WIRELESS				
BETHEL	Y	CABLE				
NOME	Y	CABLE				
BARROW	Y	CABLE				
BROWERVILLE	Y	CABLE				
KOTZEBUE	Y	DSL				
NUIQSUT	Y	MOBILE WIRELESS				

Appendix E:
Technology Adoption Rates for Alaska and Other States

State Average	Computer Ownership	Internet Adoption	Broadband Adoption
Alaska	88%	83%	73%
Florida	86%	80%	72%
Iowa	80%	72%	63%
Michigan	79%	71%	61%
Minnesota	85%	80%	72%
Nevada	83%	77%	67%
Ohio	80%	74%	66%
South Carolina	72%	66%	57%
Tennessee	79%	72%	64%
Texas	82%	73%	62%

Rural Average	Computer Ownership	Internet Adoption	Broadband Adoption
Alaska (DCCED DEF)	75%	70%	55%
Florida	72%	66%	54%
Iowa	74%	65%	55%
Michigan	80%	68%	56%
Minnesota	78%	71%	61%
Nevada	85%	77%	65%
Ohio	76%	68%	58%
South Carolina	64%	58%	47%
Tennessee	75%	68%	55%
Texas	71%	62%	48%

Non- Rural Average	Computer Ownership	Internet Adoption	Broadband Adoption
Alaska (DCCED DEF)	92%	87%	78%
Florida	87%	81%	73%
Iowa	84%	78%	69%
Michigan	78%	72%	63%
Minnesota	88%	84%	76%
Nevada	83%	77%	68%
Ohio	81%	76%	68%
South Carolina	75%	68%	61%
Tennessee	80%	74%	67%
Texas	84%	75%	64%

Appendix F: Broadband Checklist for Funders

The following are key questions that should be reviewed when broadband projects are proposed for state funding purposes:

1. ***Project objectives***: Who will be served by the new infrastructure?
   - Is it an underserved community? Does service in the area currently exist?
   - How wide is the regional coverage? How many people, businesses, municipalities will be served?
   - How will the new service interoperate with current services? Are other projects to provide the services currently under consideration and or construction? How will the initiatives cooperate?
   - Does the project include all of the necessary components to ensure success or is it reliant on other initiatives/ funding sources? If there are cooperative partners, is there an effort to meet the same goals, share costs, and build further partnerships?
2. ***Entry obstacles***: Are there permitting requirements and/or regulatory issues impacting the project? How can these be streamlined to ensure necessary steps are followed while minimizing costs and delays?
3. ***Funding sources***: Are a wide variety of stakeholders involved including local, federal, or private funds? What role does each funding source play? Are the expectations from each funding source clearly documented?
4. ***Return on investment***: Is the project ultimately profitable and if so who are the direct beneficiaries? Is it sufficient to maintain the solution?
5. ***Service***: Does the project meet expectations of current and future demand?
   - How long will the infrastructure be able to meet the anticipated needs of consumers? Does the infrastructure have an expected serviceable life span?
   - If appropriate, does the plan include service cost expectations during the useable life of the technology.
   - Is the project scalable? How does the infrastructure scale to meet increasing demands?
   - Does the infrastructure have components that offer redundant path capabilities in the event of a failure?
6. ***Ownership***: Once complete, what entities own the infrastructure? What role does the state play in ownership and future decision making on the use of the infrastructure?
   - Who is responsible for management of the network once operational?
   - Is a plan for meeting the ongoing costs included? Does the entity responsible for management have the necessary resources and a proven track record of providing services?
   - What entity services the infrastructure and makes necessary services and repairs? Does the entity possess the necessary resources to meet the obligations following a major loss?
   - Is it open for competition? Does the plan include opportunities for service providers to purchase bandwidth at market rates? How will funding be distributed to incentivize that project objectives be achieved?

APPENDIX G:
SOUTHWEST ALASKA MUNICIPAL CONFERENCE CASE STUDY

Demand Analysis for Underserved Markets of North Pacific and Arctic
Prepared by Southwest Alaska Municipal Conference

In 2012, the Southwest Alaska Municipal Conference (SWAMC) conducted broadband analysis for Southwest Alaska in coordination with the Alaska Department of Commerce, Community and Economic Development and the Alaska Broadband Task Force on Internet adoption and access. This case study determined that the lack of high-speed Internet in Southwest Alaska is due to poor economics, rather than technological difficulties. It is SWAMC's opinion that bridging the commercial gap will likely require a public investment, though offsetting the total cost will not be necessary, due to growing industrial activity reliant on modern communication. Much of the industrial activity in the area requires a link from a mobile vessel, such as a plane or boat. Multiple telecommunications providers claim they now offer this technology. In addition to residential needs and industrial demand, an opportunity exists to share costs with large population Asian markets as well.

There is an inherent supply and demand dichotomy between broadband access and adoption. Due to costs associated with building broadband, providers are reticent to deploy infrastructure, which further surpasses demand. Adoption in Alaska's western coastal communities, and especially offshore areas of the North Pacific and Arctic Ocean, represents stranded demand, and does not accurately encompass the potential penetration for high-speed broadband Internet. Shore-based facilities using legacy satellite systems provide lower data transfer speeds at very high costs, and most ocean-going vessels are not connecting to the Internet. Private companies (in addition to school districts) may pay as much as $10,000 per month for a 1.5 Mbps connection in Southwest Alaska. Next-generation fiber and satellite technologies can provide much faster data transfer speeds at a fraction of the cost.

Public investment in next-generation satellite and/or fiber networks may be necessary to provide basic information needs to residents in the area; however, with the industrial capacity growing fast in Western & Arctic Alaska, public-private partnership are likely viable options for sharing costs and increasing service.

This analysis has identified the following potential customers in Western and Arctic Alaska:

1. ***Communities - Anchor Institutions, Business, and Residential***

Exhibit A provides an overview of many SWAMC region communities that are in the underserved area. Note the Kodiak and Bristol Bay regions are connected to a fiber backbone. The underserved region contains between 15-20 communities, from Kodiak Island to the Alaska Panhandle and Aleutians that could be served by undersea fiber or next-generation satellite. In addition to the residents being deserving of cost effective and reliable Internet, anchor institutions such as schools, libraries, governments, and health facilities are under a federal mandate to meet a minimum level of service, which is currently neither cost effective nor reliable. Other industries in this region include hunting and fishing lodges that rely on satellite for their business and client needs. Businesses and residents living in these communities require broadband services if they are to remain competitive in the global marketplace and will be further restricted from services (and entertainment) that migrate to digital mediums.

2. ***Ocean Shipping and Arctic Activity***

Exhibit B displays information on vessel activity, provided by the Marine Exchange of Alaska, in the Bering Gateway to the Arctic and Unimak Pass in Alaska's Aleutian Peninsula. This ocean highway links America to Asia on the Great Circle Route, where 3,178 westbound sailings and 1,255 Eastbound sailings through Unimak Pass were recorded in 2011. Each of the past five years has led to more and more Arctic activity and development, which trickles down to the Western and Southwestern regions of Alaska. Icebreakers, tankers, researchers, escort vessels, and more are ramping up activity. The U.S. Coast Guard has documented total Arctic vessel activity increasing over 100% from 123 in 2008 to 247 in 2012, and total Bering Sea activity expanding 123% from 217 in 2008 to 484 in 2012. Most of the ships passing through these regions are large sophisticated vessels that require modern communication, and spend most of their time at sea, much of it in the North Pacific and Arctic. This represents a large and untapped market for real-time data, advanced vessel tracking, and modern communication. Russia, China, Japan, Norway, America, and many other nations are all vying for increased access in the region as the Arctic warms up. The Marine Exchange of Alaska is responsible for reporting and tracking vessels operating in Alaskan waters; through its network, vessels upload trip data when they reach port or upload information through VHF radio network to the shore-based satellite uplinks.

3. ***Science and Environmental Research***

Exhibits B provides information on science and research vessels in the Bering Gate and Unimak Pass. The region has seen increased research and science activity in recent years due to climate change, fisheries, and other information gaps necessary to understand a fragile Arctic environment. NOAA has several offices in the region, which constantly monitor and model weather patterns and climate activity. The National Marine Fishery Service does regular survey work of fisheries and marine mammals. The Alaska Department of Fish and Game's goal is to move toward real-time data collection and reporting, especially important for managing millions of pounds of harvest data. With the vast data requirements involved in creating a comprehensive understanding of environmental science, there is a great need to enhance existing networks.

4. ***Fishing Industry***

Exhibit B identifies fishing vessels by community, as reported by the Alaska Department of Fish and Game, Commercial Fisheries Entry Commission, and a more detailed analysis of vessels reporting to the community of Kodiak in 2010, provided by the Port of Kodiak. The North Pacific and Bering Sea, though sparsely populated, have some of the world's most productive commercial fishing grounds, making for year-round activity. This industry consists of many factory trawlers, at-sea processors, large and small boats, service vessels, and more; in total 9,857 vessels participated in Alaska's commercial fishing harvests in 2010. A snapshot from Alaska's largest fishing and marine sector community, Kodiak, reported 3,225 vessels calls on her port in 2010. On-shore facilities include many processors, usually at least one in each community, in addition to boat harbors and other marine businesses. Three of the nation's Top 5 seafood ports by volume reside in Dutch Harbor (#1), Akutan (#3), and Kodiak (#5), and the world's largest crab production facility is in St. Paul Island in the Pribilofs. This activity produces lots of jobs and industrial processes that require reliable communications. Even most of the smallest commercial vessels use satellite based phone systems; new technology now available offers similar hardware for Internet capable connections. The importance of reliable and real-time information to the fishing industry will require that all vessels become Internet capable. Early adopters of Internet enabled fishing vessels in Italy are maximizing harvest value and opening up new markets by finding buyers from sea, at the moment the fish are landed, so that buyers are waiting for them when fishers return to the docks.

5. ***Oil & Gas Industry***

The oil & gas and logistics industry is developing fast as the value of hydrocarbons rises and the Arctic ice recedes. Shell, Statoil, ConocoPhillips, and others are now starting their exploration activity in Alaska's Outer Continental Shelf. The staging community for Arctic activity is in the Aleutians, due to the region's ice-free, deep draft ports. Communication, vital to global energy companies, has proven to be expensive, rumored to cost $10,000 per month for a dedicated T-1 (1.5 Mbps) connection. Public officials in Unalaska are considering constructing another hotel to house the expected increased traffic due to energy exploration; each of these companies will have the same vast communication needs. Due to the data intensive needs of these companies, demand for Internet speed and capacity will increase.

6. ***Military***

The region has a large military presence due to its strategic geographic position bordering the Arctic, Asia, and the North Pacific. The largest Coast Guard base in the country is on Kodiak Island, tasked with protecting a coverage area that extends to the tip of the Aleutians and up to Barrow on the North Slope, a distance of several thousand miles. There is additional limited presence in many communities in the region, with plans for new large bases to accommodate anticipated Arctic activity. Eareckson Air Force Base on Shemya Island, at the tip of the Aleutian Chain, houses a missile defense system and weather station. The COBRA DANE is an operational, ground based, L-band large phased array radar, which fulfills three concurrent missions: intelligence data collection of strategic missile systems; treaty verification; and early warning to North American Aerospace Defense Command (NORAD). Military contractors Boeing and Raytheon are present on the island. Dedicated T-1 connections likely cost several thousand dollars per month. With the Nation's new geo-political focus on the Asian continent, this will mean maintaining advanced telecommunications networks to meet growing national security needs.

7. ***Airline Industry***

Appendix E identifies current airlines coverage as they transit the Pacific between Asian and American markets. Technology linking passenger airline traffic to the Internet is now commonplace, although without a reliable link to a satellite, this service will not be purchased. This gap provides a great business opportunity for the thousands of flights linking Asia, America, and Europe daily, over the North Pacific and Arctic. In addition to passenger traffic, Anchorage is the nation's second largest airfreight hub.

8. ***Asian Markets***

The largest opportunity to offset costs in the sparsely populated North Pacific and Arctic regions may be the densely populated Asian economies. This region, located not far from Alaska's remote communities, is home to 1.5 billion people. Even if only a small percentage of the Asian population requires satellite service, the absolute customer base is huge.

This document outlines potential and overlooked demand for high-speed Internet in the North Pacific and Arctic, independent of the basic infrastructure needs in today's modern, interconnected economy. With the predominant geography being ocean and becoming highly industrialized with mobile vessels, both undersea fiber and next-generation Ka-band satellites have the capability to deliver high-speed Internet to customers in those regions. This case study defends a need and demand for modern communication in the aforementioned regions, with the understanding that some public investment may be required. Much of this investment can be shared by leveraging public-private partnerships with the industrial base in the region.

Exhibit A

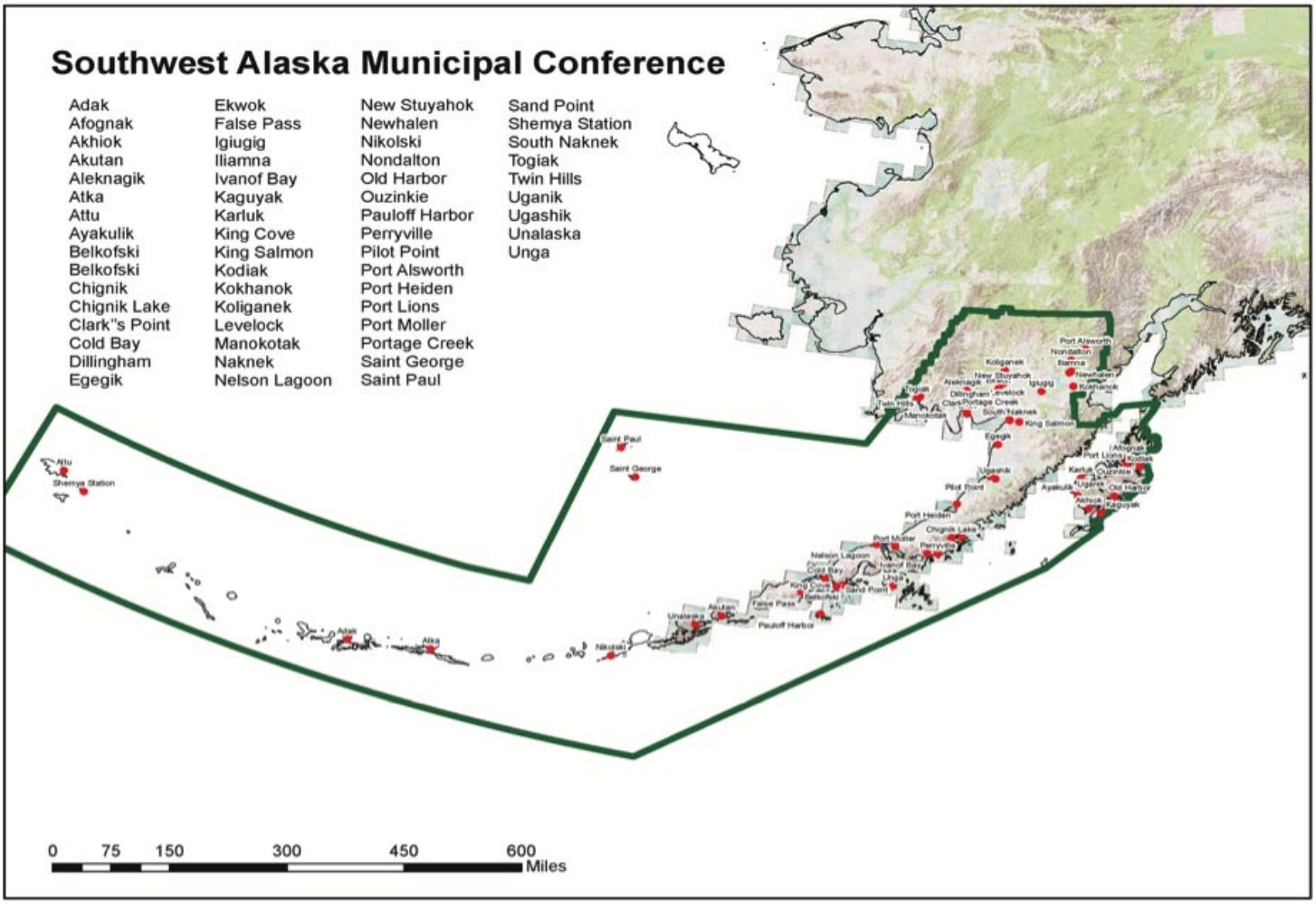
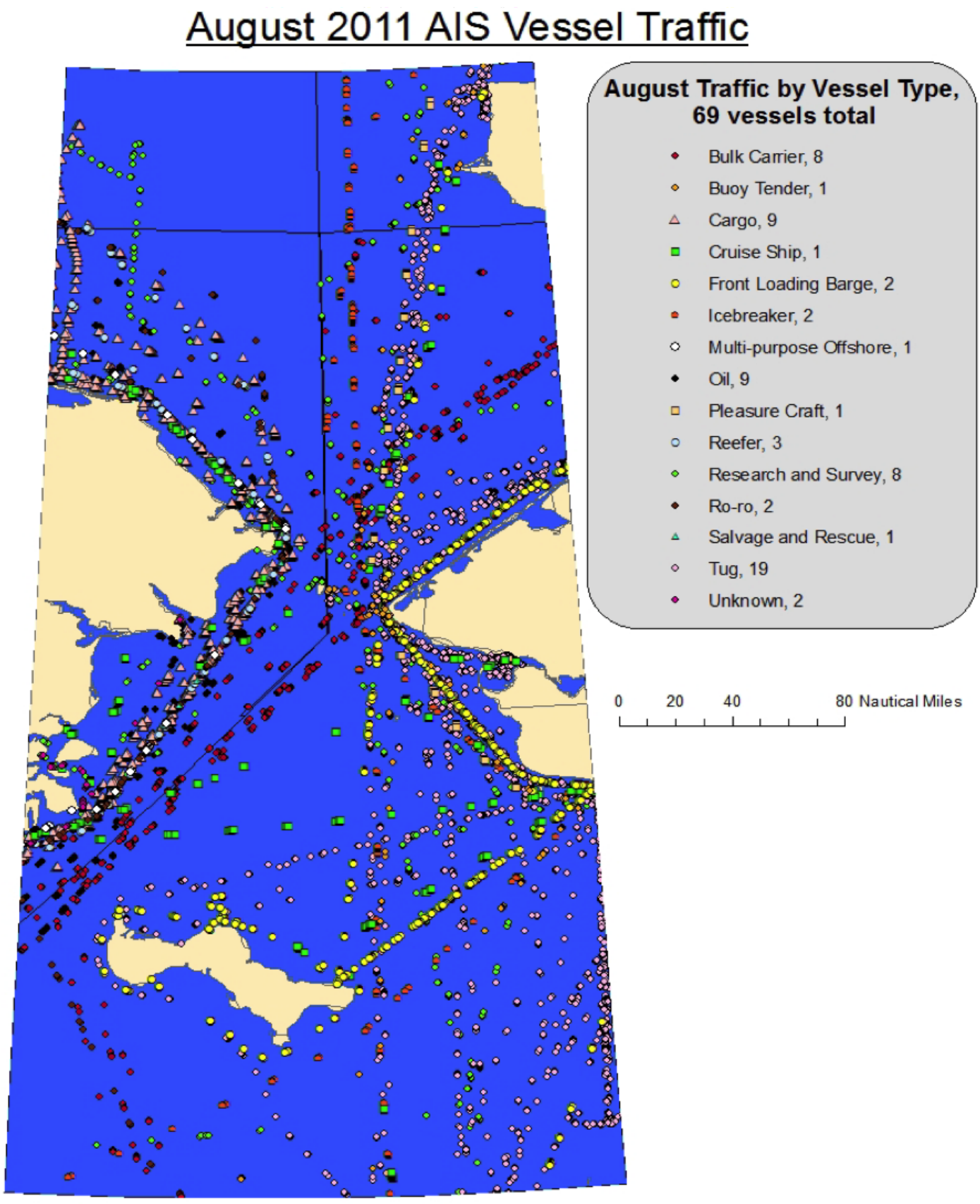

Southwest Alaska Municipal Conference
Adak
Afognak
Akhiok
Akutan
Aleknagik
Atka
Attu
Ayakulik
Belkofski
Belkofski
Chignik
Chignik Lake
Clark"s Point
Cold Bay
Dillingham
Egegik
Ekwok
False Pass
Igiugig
Iliamna
Ivanof Bay
Kaguyak
Karluk
King Cove
King Salmon
Kodiak
Kokhanok
Koliganek
Levelock
Manokotak
Naknek
Nelson Lagoon
New Stuyahok
Newhalen
Nikolski
Nondalton
Old Harbor
Ouzinkie
Pauloff Harbor
Perryville
Pilot Point
Port Alsworth
Port Heiden
Port Lions
Port Moller
Portage Creek
Saint George
Saint Paul
Sand Point
Shemya Station
South Naknek
Togiak
Twin Hills
Uganik
Ugashik
Unalaska
Unga
0
75
150
300
450
600
Miles

Exhibit B


August 2011 AIS Vessel Traffic
August Traffic by Vessel Type, 69 vessels total
Bulk Carrier, 8
Buoy Tender, 1
Cargo, 9
Cruise Ship, 1
Front Loading Barge, 2
Icebreaker, 2
Multi-purpose Offshore, 1
Oil, 9
Pleasure Craft, 1
Reefer, 3
Research and Survey, 8
Ro-ro, 2
Salvage and Rescue, 1
Tug, 19
Unknown, 2
0 20 40 80 Nautical Miles



Appendix H: Toward Universal Broadband In Rural Alaska

Executive Summary: An Analysis of Internet Use in Southwest Alaska

A Report of the Institute of Social and Economic Research
University of Alaska Anchorage

Principal Investigator: Heather E. Hudson

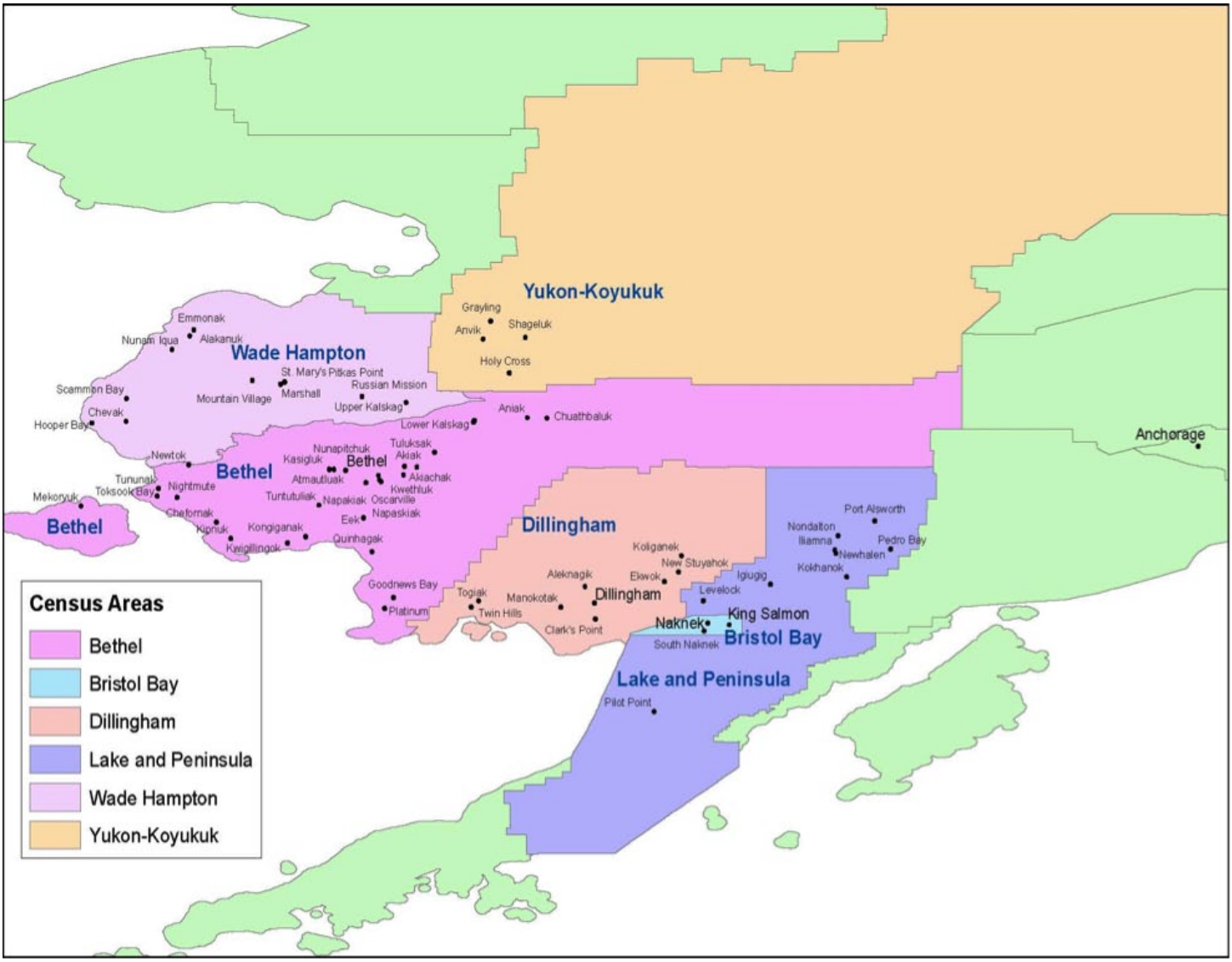
ISER Contributors: Virgene Hanna, Alexandra Hill, Khristy Parker, Suzanne Sharp, Kent Spiers, Kyle Wark



November 2012

Support for this research came from Connect Alaska with funding from the National Telecommunications and Information Administration (NTIA) for the work of the State of Alaska Broadband Task Force, with additional support from GCI.

Contact: Dr. Heather E. Hudson: hehudson@uaa.alaska.edu


Yukon-Koyukuk
Grayling
Anvik
Shageluk
Holy Cross
Wade Hampton
Emmonak
Nunam Iqua
Alakanuk
St. Mary's Pitkas Point
Scammon Bay
Mountain Village
Marshall
Russian Mission
Upper Kalskag
Chevak
Hooper Bay
Lower Kalskag
Aniak
Chuathbaluk
Anchorage
Newtok
Nunapitchuk
Kasigluk
Bethel
Tuluksak
Akiak
Akiachak
Tununak
Toksook Bay
Nightmute
Atmautluak
Kwethluk
Napakiak
Oscarville
Napaskiak
Mekoryuk
Tuntutuliak
Eek
Chefornak
Kipnuk
Kongiganak
Quinhagak
Kwigillingok
Dillingham
Port Alsworth
Nondalton
Iliamna
Pedro Bay
Newhalen
Kokhanok
Koliganek
New Stuyahok
Ekwok
Aleknagik
Igiugig
Levelock
Goodnews Bay
Togiak
Manokotak
Twin Hills
Platinum
Clark's Point
King Salmon
Naknek
South Naknek
Bristol Bay
Lake and Peninsula
Pilot Point
Census Areas
Bethel
Bristol Bay
Dillingham
Lake and Peninsula
Wade Hampton
Yukon-Koyukuk

Executive Summary:

An Analysis of Internet Use in Southwest Alaska and Literature Review

The TERRA-Southwest project is extending broadband service to 65 communities in the Bristol Bay, Bethel, and Yukon-Kuskokwim regions. A stimulus project funded by a combination of grants and loans from the Rural Utilities Service (RUS), TERRA-Southwest has installed a middle-mile network using optical fiber and terrestrial microwave. Last-mile service will be made through fixed wireless or interconnection with local telephone networks.

The State of Alaska, through its designee Connect Alaska, also received federal stimulus funding from the National Telecommunications and Information Administration (NTIA) for tasks that include support for an Alaska Broadband Task Force "to both formalize a strategic broadband plan for the state of Alaska and coordinate broadband activities across relevant agencies and organizations."

Thus, a study of the impact of the TERRA project in southwest Alaska is both relevant and timely. This first phase provides baseline data on current access to and use of ICTs and Internet connectivity in rural Alaska, and some insights about perceived benefits and potential barriers to adoption of broadband. It is also intended to provide guidance to the State Broadband Task Force in determining how the extension of broadband throughout the State could contribute to education, social services, and economic activities that would enhance Alaska's future. Results of the research could also be used proactively to develop strategies to encourage broadband adoption, and to identify applications and support needed by users with limited ICT skills.

The following are some of the conclusions from the TERRA Internet/broadband study and the literature review that are relevant for the Task Force's strategic plan.

Households: Internet and Broadband

Internet use is already quite widespread in remote communities, and two-thirds of users are online almost every day. Thus, many people in the region are already "Internet-savvy," but most are dissatisfied with slow speeds and uneven quality of service, and would like faster and more reliable connections.

Community access is important for Internet users, including those with home subscriptions. Outside the home, they access the Internet at work and at school, and also at libraries and tribal offices. About 60 percent think members of their household will access broadband elsewhere in the community, even if they subscribe at home.

There is definitely ***enthusiasm*** about broadband -- only 8 percent think their households definitely won't subscribe (this is considerably fewer than among rural residents across the country). About 45 percent think their households would definitely sign up for broadband. The remainder who aren't sure are primarily concerned about cost -- monthly subscription and overages or other charges.

Concerning likely ***uses of broadband***, personal communications and entertainment ranked highest (social networking, downloading music and video, playing online games). However, 48 percent said they expected to use broadband for education, 45 percent said they would use Skype or similar services for videoconferencing, and 39 percent said they would use broadband for work or telecommuting. The interest in education and telecommuting indicates that broadband could help residents upgrade their education and work from their homes or communities.

In many locations, more than one-third of households have their own VSATs (except in Bethel, where cable and DSL access are available). Those households with satellite service may indicate how ***early adopters*** of broadband may use the service, as they have chosen to upgrade to higher speed Internet service than is currently available from local carriers. Some 88 percent of satellite users accessed government services online, 87 percent accessed financial services, while 68 percent used the Internet for education, and 62 percent for work or telecommuting. These early adopters of the fastest connections available provide some indication that future broadband users will take advantage of broadband for work, education, and public and private sector services not available in their communities.

Educational use of broadband from home is likely to increase as more schools provide laptops to students. To derive maximum benefit from the laptops (or tablets) students need to be able to access the Internet from home, where laptops can also be shared with other family members.

Other services that residents thought they would use include online banking, reservation services, and online shopping.

Cell phone penetration is high, with 87 percent of households having at least one cell phone and 60 percent of households having a smartphone. Primary use is for voice and text, but many also use their mobile phones to access the Internet for social networking, browsing the web, and sending and receiving photos, etc. However, bandwidth and speed are limited for these applications. Some residents take their smartphones to school where they can use the WiFi connection. More than 50 percent also have an iPad or other tablet, or e-reader. Therefore, there will clearly be demand for mobile broadband.

The need for digital literacy training among people with limited experience in using the Internet, the generally widespread use of computers and other devices, and upgrades in connectivity all indicate a need ***for local employees with IT skills***. These IT workers could provide training as well as technical support in each community.

Organizations and Businesses: Internet and Broadband

Respondents from ***Native organizations*** commented that broadband could save them time in accessing online information and software compared to time required using current Internet services and would be beneficial in applying for grants and filing reports with funders, as well as assisting Tribal members applying for jobs. Some also noted opportunities to offer training in villages and to help local entrepreneurs develop websites to sell crafts and other products.

The ***tourism industry*** also requires reliable communications to support their operations and build their businesses. Fishing lodges and other wilderness tourism businesses rely on telephone and email to respond to potential customers and travel agencies to attract business. Similarly, businesses in hub communities use online services to attract customers and manage their operations.

The ***seafood processing*** industry would definitely benefit from faster connectivity to run their back office operations, such as uploading catch information, payroll, and other accounting data, and using other software for their business. They also have thousands of seasonal workers who want to use the Internet to keep in touch with family and friends and to access entertainment. Broadband wireless connectivity to boats and processing vessels would be used both to keep crews up-to-date on operations, as well as to provide personal broadband access for crews and seasonal employees. These applications for logistics and back office communications as well as for personal use by employees are also likely to apply to other key industries in rural Alaska, such as mining, oil, and gas.

The study did not include data collection on educational institutions (schools and community colleges, etc.) or ***health services***, as substantial information is available from other sources. However, these sectors will continue to be major users of connectivity. Schools offer access to online courses that are not available locally, and provide computers that students use to access the Internet for assignments and research projects. Continuing education for teachers is also available online. Increasingly, schools are providing laptops or tablets for students to use in class and take home, where it is expected that they and family members can access the Internet.

Alaska is a pioneer in telemedicine, with some 248 sites connected to the Alaska Federal Health Care Access Network (AFHCAN) network that links village clinics to regional hospitals, and regional hospitals to ANMC and other sources of specialists and consultants such as radiologists. Both schools and rural health care facilities receive subsidies for connectivity from federal universal service funds.

Highlights from the Literature Review

Broadband infrastructure appears to reduce costs and/or increase market access, and thus lead to job creation and growth in total employment. A World Bank study concludes that every 10 percent increase in broadband penetration accelerates economic growth by 1.38 percent in low and middle income countries (which are perhaps more comparable to Alaska's rural economy than national economies of OECD countries).

Several studies examined impact on sectors that are found in Alaska. For example, broadband can contribute to employment growth both as a result of infrastructure construction and spillover effects on the rest of the economy, particularly in sectors with high transaction costs such as financial services, education, and health care. Another study found that broadband deployment positively impacts mining, construction, information, and administration. Some of these findings were echoed in another study that found broadband expansion and employment growth varies across industries, and that the positive relationship is especially large for utilities; information; finance and insurance; professional, scientific, and technical services; management of companies and enterprises; and administrative and business support services. It also noted that the relationship between broadband and employment growth is stronger in places with lower population density.

Benefits can be classified in terms of:

- ***Efficiency***: such as saving them time in applying for grants and filing online reports and business data; keeping track of inventory; and managing operations;
- ***Effectiveness***: referring to the quality of services provided such as in health and education;
- ***Equity***: reducing the distance barriers between rural and urban communities by providing access to information, entertainment, education, and other services not otherwise available to remote communities;
- ***Reach***: enabling Alaskans to extend their range electronically to market Native crafts, tourism, and other local assets.

Concerning ***e-governance,*** a study found that increasing the broadband network significantly reduces inefficiency in state economies. Another study stated that use of social media as part of e-governance strategies increases social and digital inclusion and thereby political inclusion.

Studies of ***natural resource industries*** such as mining, fisheries, forestry, and petroleum report that broadband can be used for logistics and back office management, training of workers, and, in some cases, supporting development of new markets or trading partners.

Concerning ***public safety and disaster communications***, experiences with manmade and natural disasters in the U.S. ranging from terrorist attacks to floods, oil spills, and forest fires have demonstrated the need for telecommunications networks that are robust and interconnected. In Alaska, beneficiaries could include village public safety officers, forest fire fighters, oil spill response teams, etc.

However, several studies point out that broadband and other investments in information and communications technologies (ICTs) may be ***necessary but not sufficient*** for economic development. As one researcher points out, the impact of broadband is neither automatic nor homogeneous across the economic system. Therefore, public policies may be needed in other areas such as telecommunications regulation, education, economic development and planning, and science and technology.

Estimating Benefits for Alaska

Estimating the value of benefits of broadband investment in Alaska was beyond the scope of the current ISER research. However, several approaches could be considered to determine an estimate of the number of workers and organizations/ businesses that would benefit, and some idea of new job creation.

For example, beneficiaries could include:

- Education: total number of rural students and rural teachers
- Health care: total number of rural health aides
- Public safety: total number of Village Public Safety Officers (VPSOs) etc.
- Native organizations: Native corporations, village corporations, Tribal councils, Native nonprofits, etc.
- Resource industries: seafood processing companies, mining companies, oil and gas companies, etc.
- Tourism: ecotourism, tour operators, lodges, etc.
- Other rural businesses: estimates of number of businesses from state data

For workers in these sectors, their jobs may be enhanced and skills improved by access to broadband. For many of these entities, economic benefits may be cost savings in terms of increased efficiency or travel substitution. For example, research by ANTHC has documented travel savings from telemedicine of over $2.85 million dollars for Medicaid from 2003 to 2009, so that for every $1 spent by Medicaid on reimbursement, $10.54 was saved on travel costs. For others, there may be increased revenue and possibly new jobs such as from more grant funding received by Native organizations, more business for tour operators and lodges, etc.

It is difficult to estimate the number of new jobs resulting from broadband availability, but it may be possible to indicate some types of new jobs, such as:

- IT workers/trainers in each community;
- Self-employed entrepreneurs who could sell crafts, other products online;
- New types of jobs such as environmental monitoring;
- Possibly new jobs such as telework to do back office data entry or customer support, etc.

Benefits in terms of upgrading skills and accessing services such as banking and online shopping that would improve quality of life and save money or increase income could potentially accrue to all adult rural residents.

Finally, it is worth noting that while the rural Alaska population is relatively small, it is also young. For example, the median age in the Wade Hampton Census Area is 22.5; in the Northwest Arctic Borough, 25.7; in the Bethel Census Area, 26.4; and in the Nome Census Area, 27.5. Rural Alaska youth will grow up using computers and mobile phones, but will also need job opportunities if they are to remain in their communities as adults.

The full ISER report is available at http://www.alaska.edu/files/oit/bbtaskforce/docs/2012-11-ISER_Terra-SW_Study.pdf.

Appendix I: Literature Review

At the request of members of the State Broadband Task Force, a literature review has been prepared concerning the role and impacts of broadband in social and economic development. The review lists references under the following headings:

- Economic Analyses and International Organization Studies
- Rural and Regional Development
- Alaska and the North
- Adoption
- Sector Studies:
  - Education and Libraries
  - Health Care
  - E-Commerce, Rural Business, and Natural Resources
  - E-Government
  - Public Safety and Disaster Communications

References relevant to Alaska have been highlighted, with a focus on rural, remote, and northern regions, and on sectors important to the Alaska economy. In general, references are from the period 2005 to the present, although some earlier studies that appear highly significant are included. Some studies listed under one heading include several topics (such as education and health care as components of rural development).

It is important to note that the references listed are illustrative and not exhaustive. Many more publications are available on each of these topics. The bibliography includes the National Broadband Plan because it refers to many potential benefits of broadband included in the sector analyses, but it does not include policy documents such as FCC Notices and accompanying filings. It also does not include a complete list of state broadband plans. Links to many of these can be found on the Alaska Broadband Task Force homepage.

References to authors in the text refer to full citations in the bibliography.

International Comparisons

International organizations such as the International Telecommunication Union (ITU) and Organization for International Cooperation and Development (OECD) collect national data on broadband availability and pricing (see OECD 2011). The OECD reports on its membership, which is comprised primarily of industrialized countries, while the ITU reports on all of its more than 200 member states. The World Bank has also published data and case studies on information and communication for development (IC4D) (see World Bank 2009 and 2012).

OECD data for 2011 rank the U.S. 15th in broadband subscriptions per 100 inhabitants at 27.7 percent. All northern countries except Russia rank higher: Denmark (37.9%), Norway (35.7%), Iceland (34.6%), Sweden (32.5%), Canada (32.0%), and Finland (29.6%).[1] Of course, these are national data, and do not reveal disparities within countries. However, with the exception of Greenland, broadband access is widespread throughout these countries. Finland, which has declared Internet access a human right, is extending broadband to all – including its northern regions.[2]

1 OECD data for December 2011. Accessible at http://www.oecd.org/internet/broadbandandtelecom/oecdbroadbandportal.htm
2 Personal communication, Kirsti Westphalen, Consul General of Finland in Los Angeles, September

The ITU has just published The State of Broadband 2012: Achieving Digital Inclusion for All, a report published for the UN Broadband Commission, which it co-chairs with UNESCO (ITU, 2012). The report includes data on broadband penetration in all its member states, and case studies on digital inclusion, making broadband affordable, and getting people online. The ITU (2007) has created a Digital Opportunity Index (DOI) based on 11 information and communication technology (ICT) indicators, grouped in 3 clusters: opportunity, infrastructure, and utilization. The Digital Opportunity Index measures these aspects, including price and affordability of ICTs (including Internet and mobile) relative to average income. According to this index, South Korea ranks first, and the U.S. ranks 20th. Other northern countries rank higher than the U.S.: Denmark 3rd, Iceland 4th, Sweden 9th, Finland 11th, Norway 12th, and Canada 17th.

Economic Analyses and National Studies

Numerous economic analyses have attempted to quantify the contribution of broadband to economic growth, primarily measured by GDP. While these studies can point to potential outcomes of broadband investment, most focus at the national level, and particularly on industrialized economies (such as the U.S. and other OECD countries). Alaska's economy and remote indigenous population have more in common with some developing countries. However, broadband investment in developing regions remains limited to date.

Researchers have taken several approaches to analyze the impact of telecommunications, and more recently, broadband, on economic development. Macroeconomic studies have analyzed multi-year and multi-economy datasets, typically examining communications infrastructure investment and GDP growth or employment. Microeconomic studies at the firm level have examined broadband impact on productivity and growth in sales or revenues. Case studies have also examined impacts in various sectors or industries.

An example of the macroeconomic analysis approach is a recent World Bank econometric analysis of 120 countries showed that for every 10 percentage point increase in the penetration of broadband services, there is a 1.2 percentage point increase in per capita GDP growth, and 1.38 percentage increase in developing countries. (2009).

In a report for the ITU, Katz (2012) summarizes the main findings:

> *A review of the research on the economic impact of broadband indicates multiple effects. First and foremost, the evidence is fairly conclusive about the contribution of broadband to GDP growth. While the amount of this contribution varies, the discrepancies can be related to different datasets as well as model specifications. Secondly, broadband has been found to have an impact on the productivity at the firm level. Evidence generated both at the micro-economic and macro-economic level appears to confirm this effect. In addition, research has been successful in identifying the existence of a critical mass, indicating the existence of increasing economic returns of broadband penetration. On the other hand, consistent with the research at the ICT level, broadband economic impact could be mediated by a lag effect, indicating that adoption does not automatically translate into growth but that it would require the accumulation of intangible capital, defined as the changes in business processes and firm culture that lead to assimilation of improved business processes.*

He notes that broadband can contribute to employment growth both as a result of infrastructure construction and spillover effects on the rest of the economy, particularly in sectors with high transaction costs such as financial services, education, and health care. Numerous studies have also identified consumer surplus in the form of benefits to the customer not captured in GDP data, such as transportation savings and access to entertainment and social services. These are typically measured as the difference between what users are willing to pay for broadband and prices of broadband services.

However, Katz also notes several caveats:

> *First, broadband exhibits a higher contribution to economic growth in countries that have a higher adoption of the technology… Second, broadband has a stronger productivity impact in sectors with high transaction costs, such as financial services, or high labour intensity, such as tourism and lodging. Third, in less developed regions … broadband enables the adoption of more efficient business processes and leads to capital-labour substitution and, therefore loss of jobs…. Fourth, the impact of broadband on small and medium enterprises takes longer to materialize due to the need to restructure the firms' processes and labour organization in order to gain from adopting the technology …. Finally, the economic impact of broadband is higher when promotion of the technology is combined with stimulus of innovative businesses that are tied to new applications.* ***In other words, the impact of broadband is neither automatic nor homogeneous across the economic system****. This emphasizes the importance of implementing public policies not only in the areas of telecommunications regulation, but also in education, economic development and planning, science and technology, and others.* (bolding added)

This research grew out of numerous studies on the role of telecommunications in socio-economic development beginning in the late 1970s (see Hudson 2006). In general, time-series analyses showed that while economic development contributed to telecommunications growth (countries with higher GDP had higher investments in telecommunications and other infrastructure), there was a small but significant contribution of telecommunications to economic development (investment in telecommunications led to higher GDP per capita). With the rapid diffusion of mobile telephony in the developing world during the last decade, researchers have attempted to quantify its impact on economic growth. A study by Waverman et al. (2005) examined the impact of mobile phones in developing countries, concluding that differences in the penetration and diffusion of mobile telephony certainly appear to explain some of the differences in growth rates between developing countries.

A review by Holt and Jamison concludes: "The lesson from the US appears to be that broadband has a positive economic impact, but that impact cannot be analyzed with any precision." They note that "One of the difficulties learned from studies of the effects of ICT is that impacts evolve…."

This conclusion is perhaps most relevant for Alaska, as is Katz's comment that "the impact of broadband is neither automatic nor homogeneous across the economic system." Forecasting overall economic impact of universal broadband in Alaska is challenging, given the structure of the Alaska economy, with its dependence on natural resources and on public sector services. However, research on rural development and case studies of sectors relevant to Alaska provide insights about potential impacts. These are reviewed in the sections below.

Rural and Regional Development

Hudson (2006) states that telecommunications can contribute to socio-economic development in general and rural development in particular, through improving:

- Efficiency
- Effectiveness
- Equity
- Reach

All of these are relevant to the Alaska context. In the TERRA survey, managers of Native organizations, rural industries such as seafood processing, and rural tourism businesses in southwest Alaska all stated that broadband would make their work more efficient, saving them time in applying for grants and filing online reports and business data; keeping track of inventory, boats or aircraft; and managing their operations.

Effectiveness refers to the quality of services provided. In education, for example, online courses and other content can improve the quality of education available in small village schools. Remote students taking University of Alaska distance education courses say they need broadband to participate more effectively in the online activities and interaction. Use of telemedicine facilities improves the quality of village health care by making it possible for physicians at regional hospitals to diagnose and recommend treatment for village patients and by sending patient data and test results electronically rather than waiting for hardcopies.

Equity-related benefits in Alaska result from reducing the distance barriers between rural and urban communities by providing access to information, entertainment, education, shopping, and other services that are not otherwise available to remote communities.

Reach refers to the ability of Alaskans to extend their markets electronically to market Native crafts, fish and other products, wilderness recreation and tourism, and other local assets.

Studies of the impact of broadband in other rural regions can provide some indications of potential impact in Alaska. Shideler et al. (2007) found in Kentucky that broadband deployment had a significant impact on a region's employment growth.

> *Broadband infrastructure appears to reduce costs and/or increase market access, and thus lead to job creation and growth in total employment. At the sectoral level, broadband deployment positively impacts mining; construction; information; and administration, support, and waste management and remediation services. Broadband deployment does contribute to employment growth within real estate, rental, and leasing; arts, entertainment, and recreation; and other services; however, for these three sectors, other economic variables appear to be more influential to job growth than the availability of broadband…. Weak evidence suggests that broadband availability may positively impact retail trade; professional, scientific, and technical services; and health care and social assistance, though the impact is likely to be indirect given the supporting nature of these industries to the economy.*

A study on *Broadband Internet's Value for Rural America* by the U.S. Department of Agriculture (Stenburg et al. 2009) focuses on agriculture, but some of its findings appear relevant for Alaska. Their analysis of farm use of broadband supports the hypothesis that people embrace terrestrial broadband when given the option. They suggest that as farm operators "increase their participation in e-commerce, their relationships with local suppliers are likely to weaken. Farm operators may increasingly opt for distant suppliers to secure lower prices or better access to niche inputs. Suppliers with an established Internet presence, including local ones, would appear better positioned to retain customers within the local economy." They also find that household characteristics such as age, education, presence of children, and household income are significant factors in adopting broadband Internet use. Generally, rural economies benefit from broadband availability: "In comparing counties that had broadband access relatively early (by 2000) with similarly situated counties that had little or no broadband access as of 2000, employment growth was higher and nonfarm private earnings greater in counties with a longer history of broadband availability."

In reviewing research on broadband and rural development for the Alberta government, Irshad (2009) concluded:

- Development of a community of broadband users requires more time, support, and investment than is usually anticipated.
- Technology training is a necessary component for adoption and deployment of broadband in rural communities.
- The best community developments are led by the community itself – specifically those local early adopters and champions – and not by outside enthusiasts or technologists.
- E-learning is a growing market, but e-shopping, communications, and entertainment are the primary drivers of domestic broadband take-up.

A study by Kolko (2010) for the Public Policy Institute of California found that the relationship between broadband expansion and employment growth varies across industries, and that the positive relationship is especially large for utilities; information; finance and insurance; professional, scientific, and technical services; management of companies and enterprises; and administrative and business support services. He also noted that the relationship between broadband and employment growth is also stronger in places with lower population density, "consistent with the theory that smaller or more isolated areas may benefit more from high-speed connections, giving businesses in these areas access to larger markets. However, even for most high density areas, the relationship between broadband and growth remains positive on balance, just not as large as for lower-density areas." His conclusion appears relevant for rural Alaska: "None of the other place characteristics—such as having a more educated workforce, having a better climate, or being a vacation destination—affects the relationship between broadband expansion and employment growth."

The North

Experience from across the North, particularly from Canada, provides valuable insights for Alaska in terms of broadband planning for remote areas and services provided by and for indigenous populations.

In 2011, a Canadian Arctic Communications Infrastructure Assessment (ACIA) was completed to identify "the issues and challenges facing governments and service providers in ensuring the Canadian Arctic is properly connected for the benefit of Arctic citizens and all Canadians." The realities they cite that have led to the state of Canadian Arctic infrastructure are similar to those in Alaska:

1. The geographic facts make the entire Arctic region challenging from an economic perspective for building, maintaining, and evolving communication services that meet users' needs at an affordable price, without significant public investment.
2. The existing network investment models in the North are not meeting the rapid pace of increasing change and convergence of communication services available in the South.
3. There is currently no comprehensive strategy for connecting all Arctic communities to the level of service required within communities or between communities (Imaituk, 2011).

The assessment reviews existing telecommunications capacity, problems, technology options, and requirements, primarily for government services in Arctic communities. It also includes maps showing which services are available in each community in the Canadian Arctic, as of February 2011. Among its recommendations are:

- Commit to service parity among Arctic communities, and set minimum connectivity standards for all Arctic communities that assure service parity to southern urban centers.
- Investment strategies for Arctic communication networks must include provisions for the increasing rate of change of technology and the continuous introduction of new consumer services and devices.
- Investment models should allow, even encourage, competing services in as many market segments as possible, thereby promoting consumer and government choice along with innovation and improved services.

This report could serve as a template for much of the material required in an Alaska broadband plan. It is interesting to note that the unit of analysis the ACIA uses is the community rather than the household, to achieve "parity to southern urban centers."

There are several examples of indigenous entities providing broadband capacity and services in Canada. Qiniq (meaning "to search") is a network delivering broadband connectivity to 25 communities in Nunavut in the Canadian Arctic. As in most of Alaska, in Nunavut there are "no highways, no power or phone lines, no fibre optic networks, and no microwave relays linking communities" and the most common method of supplying communities with goods is air or barge. The Nunavut Broadband Development Corporation (NBDC) was formed to establish Internet services in Nunavut communities; participants included Nunavut government officials, Inuit organizations, and private sector companies. Initial federal government funding enabled the NBDC to produce a business case for broadband in Nunavut and to build some of the infrastructure. Qiniq states that the cost to build the Nunavut network with satellite distribution and local fixed wireless was $9 million. Qiniq also provides local support, with each community having a community service provider, a local person who was trained to "install wireless modems, handle basic troubleshooting, and involve people in the initiative." Involving local people was seen as one of the key factors in achieving success. (Qiniq, 2012)

Another network serving remote northern communities is K-Net (the Kuh-ke-nah Network), an aboriginal-owned community ICT network that provides Internet access to the Cree and Ojibway communities in northern Ontario. These remote communities are similar in isolation (no road access) and size (300 to 900 people) to Alaska Native villages. K-Net contracts with carriers to provide bandwidth for communities, helping them to establish local ISPs. It also contracts with health care providers to provide telehealth networks, and, with the Ontario Ministry of Education, to support an online high school (Keewaytinook Internet High School -- KIHS) through which students in remote communities can complete their GEDs. K-Net provides computer training and skills development for community members and community networking. K-Net also manages a satellite-based network providing videoconferencing services to Native communities in northern Ontario, northern Quebec, and northern Manitoba. K-Net videoconferencing facilities are also used for social gatherings to link elders in remote Northwestern Ontario villages. (See www.knet.ca and Fiser and Clement, 2009).

The Ktunaxa Nation Broadband Network is located in southeastern British Columbia and was originally conceived to disseminate the disappearing Ktunaxa language. It has utilized the FirstVoices initiative, which "is a suite of web-based tools and services designed to support Aboriginal people engaged in language archiving, language teaching, and cultural revitalization." Community learning centers (CLCs) operate in Ktunaxa Nation communities resulting from a partnership with the University of British Columbia (UBC). (Slonowski, 2008).

Another Native-owned communications provider is GwaiiTel, which makes high-speed Internet service available to residents of seven communities of Haida Gwaii (Queen Charlotte Islands). GwaiiTel was formed by the Gwaii Trust, a nonprofit organization established to enhance environmentally sustainable social and economic benefits to Haida Gwaii/ the Queen Charlotte Islands through its perpetual trust fund. Connection to the mainland is over North America's longest over-water radio link for Internet transmission. GwaiiTel invested more than $1 million (Canadian) to build infrastructure connecting the islands' communities, with funding from the Gwaii Trust Society and a grant from Industry Canada's Broadband for Rural and Northern Development Pilot Program (BRAND).

"K-Net, Ktunaxa, and Qiniq are powerful examples of Aboriginal organizations taking control over the what and the how by responding to the realities of the communities, and strengthening them in the process. K-Net started as a response to the need to maintain contact with the youth that left the communities to further their education, Ktunaxa was born by the concern of the loss of the traditional language, and Qiniq emerged from the vision of a practical initiative to decrease the isolation of the communities" (McMahon, 2011). GwaiiTel is another example of a Native initiative to provide broadband to isolated northern Native communities.

Hudson (2011) compares telecommunications policies concerning rural and remote regions in the U.S., Canada, and Greenland. Greenland now has submarine fiber links to Europe via Iceland and to North America via Newfoundland and is upgrading local access, but prices remain high. In Canada, there is a relatively small high cost fund – nothing comparable to the U.S. E-Rate program. In 2011, the Canadian Radio-Television and Telecommunications Commission (CRTC), which is comparable to the FCC, stated that broadband users should be able to "stream higher-quality audio and video and to participate in videoconferencing at reasonable quality using online services. This capability will enable users to engage in such activities as participating in distance learning and online consultations with professionals (basic e-health)." To accommodate such uses, the CRTC set a target for broadband access of a minimum of 5 Mbps download and 1 Mbps upload. The CRTC noted that "while many Canadians in urban areas already have access to broadband Internet services at or above these target speeds, such speeds are not currently available to most Canadians in rural and remote areas." It also stated that target speeds are to be actual speeds delivered, not merely those advertised. It expects that "the target speeds set out above will be available to all Canadian homes, regardless of their geographic location, through a range of technologies" by the end of 2015 (CRTC, 2011).

Adoption

The ***Digital Nation*** series of studies by the Economics and Statistics Administration and the National Telecommunications and Information Administration (NTIA) in the Department of Commerce provide detailed analyses of broadband adoption in the U.S., with data disaggregated for many variables including ethnicity, age, education, income, and urban vs. rural location. (NTIA 2010, 2011). In 2011, about 7 out of 10 households in the U.S. were broadband subscribers. The analysis found a strong correlation between broadband adoption and socio-economic factors, such as income and education, but that these differences did not explain the entire broadband adoption gap that exists along racial, ethnic, and geographic lines. "Even after accounting for socio-economic differences, certain minority and rural households still lag in broadband adoption." The most important reasons households without broadband Internet or dial-up service gave for not subscribing were lack of need or interest (47 percent); lack of affordability (24 percent); and inadequate computer (15 percent). Households reporting affordability as the major barrier to adoption cited both the fixed cost of purchasing a computer and the monthly subscription costs as important factors.

Another national study was carried out by Horrigan (2009) as part of the FCC's research for the National Broadband Plan. At that time, about 65 percent of Americans used high speed Internet at home. There were three primary reasons why the 35 percent of non-adopting Americans did not have broadband: cost, lack of digital literacy, and broadband was not sufficiently relevant for them to purchase it. The main dividing lines were socio-economic, particularly income and education. Horrigan also provides data on adoption among various ethnic groups, seniors, and people with disabilities.

As noted in the introduction to our TERRA study report, these studies provide many valuable insights. However, their sample for Alaska is small, and the data on rural Alaska are too limited to be useful.

Other research has examined various barriers to adoption. Some case studies had similar findings on adoption to the national studies. LaRose et al. (2011) found in Kentucky: "Prior experience with the Internet, the expected outcomes of broadband usage, direct personal experience with broadband, and self-efficacy had direct effects on broadband intentions. Age and income, but not education or ethnicity, also had direct impacts." They conclude: "Public education efforts in a community participating in the ConnectKentucky initiative had an incremental effect on broadband adoption by positively affecting residents' perceptions of broadband service."

A report on broadband adoption in low income communities prepared for the FCC by the Social Science Research Council concluded that:

- ***Broadband access is increasingly a requirement of socio-economic inclusion***, not an outcome of it -- and residents of low-income communities know this.
- ***Price is only one factor shaping the fragile equilibrium of home broadband adoption***, and price pressures go beyond the obvious challenge of high monthly fees. Hardware costs, hidden fees, billing transparency, quality of service, and availability are major issues for low-income communities.
- ***Libraries and other community organizations fill the gap between low home adoption and high community demand***, while providing a number of other critical services such as training and support (Dailey et al., 2010).

Concerning communications in tribal regions, Mark Goldstein of the United States Government Accountability Office (GAO) testified before the U.S. Senate Committee on Commerce, Science, and Transportation that lack of telecommunications training and knowledge among tribal members is a barrier to improving their telecommunications. He quoted a tribal official who stated that: "tribes without technically trained staff would be at a disadvantage in negotiating with service providers. This official added that having tribal members trained in telecommunications was necessary to ensure that a tribe's planned improvements included the equipment and technology the tribe wanted and needed" (Goldstein, 2006).

Goldstein noted that some tribes are addressing the shortage of technically-trained tribal members to plan and implement improvements on tribal lands through mentoring and partnerships with educational institutions. Examples include the Yakama Nation that proposed to connect a local university to its telecommunications system in exchange for technical training for its staff and The Mescalero Apache Tribe, which "improved its technical capacity by hiring technically trained staff and pairing them with less trained staff, creating a technical mentoring program" (Goldstein 2006).

There have been many studies on models of community access. In developing countries, a telecenter often provides communications facilities for those without equipment or connectivity. Similar approaches have been used in other contexts such as "community online access centres" in Australia, and CTCs (community technology centers) in the U.S. Such centers often also provide training, and may include "infomediaries," which are resource personnel who can help users find information as well as use a computer (Hudson, 2006).

Sector Studies

Education, Libraries, and Research

Alaska's experience with using telecommunications to support rural education dates from satellite experiments in the 1970s, which distributed first audio and then video educational content to village schools. In the 1980s, the LearnAlaska project produced some educational programs for villages and delivered video content requested by teachers on the same transponder at night so that they could set the school VCRs to record the materials for future use. (See ISER 2011 and Hudson and Pittman 1999.) In the 1990s, village high school students were able to take some satellite-based telecourses delivered by regional and national educational consortia in subjects such as foreign languages and advanced mathematics and sciences that were not offered in village schools. With the advent of the Internet, courses and research materials became available online. Schools added computers and sought to connect them to the Web. Local libraries also became an important source of information from the outside world. Community residents without computers or connectivity could use library computers to send e-mail, do research for class projects, purchase goods available online, search for jobs, and find other information or connect with distant family and friends.

Distance education is important for Alaska at the K-12 level to augment capacities in rural schools, for access to post-secondary education and training in rural areas, and for continuing education such as for health aides, teachers, and public safety officials. Many studies have demonstrated that distance delivery can be as effective as in-person instruction (see, for example, Bernard et al, 2004 and Daniel, 2005). In higher education, the University of Alaska delivers courses online to reach students unable to attend classes on campus and leases broadband capacity to link its rural campuses to the main campuses. As more universities around the world make courses available online, broadband will be the means by which Alaskans can take advantage of these new resources.

Libraries are a major resource for community access to computers and the Internet across the U.S. including in Alaska. Bertot (2009) points out that "... public libraries are in a perpetual cycle of planning and implementing various [public access] services and resources. Either hardware needs to be updated or replaced, or there is a software update that needs to be installed, or libraries are looking to the next technology coming down the road. In short, the technology planning to implementation cycle is perpetual." Users increasingly expect "a 'MyLibrary.com' experience that allows for seamless integration across the library's services but also facilitates the use of personal technologies (e.g., iPods, MP3 players, and USB devices). Thus users expect the library's services to resemble those services offered by a range of information service providers."

As noted in the TERRA survey report, both schools and libraries are important for community access in rural Alaska. While facing needs for frequent upgrading of facilities as pointed out above, they benefit from subsidies for connectivity from the E-Rate program, part of the FCC's universal service fund (USF). Typically, Alaska's schools and libraries qualify for subsidies ranging from 70 to 90 percent of the charges for connectivity. From 1998 through 2011, Alaska received more than $211 million from the E-Rate program, among the top states in per capita support in the country.[3]

Researchers in Alaska will also have increasing need for broadband. University researchers rely on connectivity to access information, share computing resources, and collaborate with colleagues around the world. The Alaska State Committee on Research (SCoR) has recently drafted a plan for the future of science and technology in Alaska that includes education and training for future innovators, research coordination, and improvements in telecommunications infrastructure among its priorities (Alaska State Commission on Research, 2012).

In addition, regional and field research centers funded by the federal government such as the Centers for Disease Control, U.S. Geological Survey, the Department of the Interior, and the Barrow Arctic Research Center (which also has research facilities in the village of Atqasuk and supports research in Chukotka, Russian Siberia) require broadband connectivity to transmit field data, access remote computing facilities, and collaborate with other researchers. Also, broadband in the form of videoconferencing can enable indigenous experts in the North to participate in research, for example, to identify and explain artifacts held in distant museums and research collections (Garrick, 2008).

Health Care

Alaska has been a pioneer in rural telemedicine, dating from experiments with NASA satellites in the 1970s. Previously, village health aides had relied on two-way radio for a daily "radio call" with doctors at regional hospitals and to reach hospitals in an emergency. The radio system was notoriously unreliable in much of remote Alaska, and in some cases, radios were only in doctors' homes and not at the clinic. The experiments on NASA satellites showed that reliable voice communication between health aides and doctors could improve diagnosis and treatment of village patients, generally resulting in fewer patient evacuations (Hudson and Parker, 1973). These experiments were followed by installation of commercial satellite earth stations that brought telephone service to every permanent community of at least 25 people and a dedicated voice network linking village clinics to regional hospitals. This investment required the collaboration of the State government, the Public Health Service, and the private sector.

The AFHCAN (Alaska Federal Health Care Access Network) was established in the 1990s to provide greater support to village health aides by adding a terminal in each clinic with a computer and peripheral equipment such as an electronic otoscope, EKG monitor, and digital camera. The system was originally designed to operate over low bandwidth, but upgrades now include videoconferencing for training and patient consultations, and current implementation of an electronic health records (EHR) system. The increased bandwidth has been possible largely due to FCC Universal Service Fund (USF) subsidies for rural health care, which pay the difference between the costs of connectivity in rural areas and Anchorage. In 2011, Alaska received more than $44.7 million – more than 53 percent of the total amount allocated by the fund.[4]

3 Derived from data available at www.usac.org
4 Derived from data available at www.usac.org

Today, Alaska remains a global leader in telemedicine, with 248 sites and more than 33,000 cases per year. Research by ANTHC has also documented travel savings of over $2.85 million dollars for Medicaid from 2003 to 2009, so that for every $1 spent by Medicaid on reimbursement, $10.54 was saved on travel costs (Ferguson and Kokesh, 2011).

In a study of electronic health record (EHR) adoption throughout the Indian Health Service, Sequist et al. (2007) found that, of responding physicians, two-thirds felt that the EHR implementation process was positive. The majority (87%) of clinicians felt that information technology could potentially improve quality of care in rural and underserved settings through the use of tools such as online information sources, telemedicine programs, and electronic health records.

However, Bahensky (2008) notes that financial barriers and a large number of health information technology (HIT) vendors offering different solutions present significant risks to rural health care providers. "Although evidence in the literature has demonstrated benefits of adopting HIT such as EMRs (electronic medical records), important technical, policy, organizational, and financial barriers still exist that prevent the implementation of these systems in rural settings."

E-Commerce, Rural Business and Natural Resources

E-Commerce

In its comments to NTIA in 2009, the State of Alaska pointed out how broadband could facilitate e-commerce and other e-service applications in rural Alaska: "The availability of the Internet through broadband access offers the best method for advertising goods and services in Alaska's rural communities. Enterprises such as ecotourism businesses and Native handicrafts are just two examples of how broadband can aid economic development. Internet access also offers a means to purchase supplies and equipment which can reduce the cost of doing business.

Additionally, broadband access encourages businesses to take advantage of the full range of internet services such as federal tax preparation and reporting, internet banking, grant and loan applications, participation in training opportunities, networking through trade associations, research, and general communications" (State of Alaska, 2009). A study for the USDA Alaska Service Center added: "Broadband, in combination with renewable energy development, could also open the door for job creation in placement of server farms and electronic document storage" (USDA, 2010).

It should be noted that most Alaska businesses are very small. More than 60 percent have 4 or fewer employees, and a total of 89 percent of businesses have fewer than 20 employees. However, half of Alaska jobs are in firms with 100 or more employees.[5]

A study by Connect Alaska (2011) cites examples of how Alaska businesses use technology more intensively or differently from businesses elsewhere in the U.S. For example:

- Among Internet-connected businesses in Alaska, almost three-fourths (72% or 12,000 businesses) research or book business travel arrangements online; significantly higher than the average among Connected Nation states/territories.
- Seven out of ten rural Alaskan businesses (70%) indicate that they use the Internet to track and control their shipments online, which is vital for remote businesses; this is significantly higher than the average among rural businesses in Connected Nation states/territories.
- Nearly three out of five (57%) Internet-connected Alaska businesses in the High Tech sector provide online training; this is significantly higher than the average within the High Tech sector across Connected Nation states/territories.

5 Alaska Department of Labor and Workforce Development, *Alaska Economic Trends*, vol. 32, no. 9, September 2012.

Connect Alaska also found that across Alaska, 23% of businesses (approximately 5,000) allow employees to telework. This is similar to the percent of businesses that allow teleworking in other regions where Connected Nation operates.

However, there may be barriers to adoption of broadband by rural businesses. Pociask (2005) finds both demand-side and supply-side barriers. Demand may be low not only because of small populations but also where rural residents are somewhat older, less wealthy, and less educated than urban households – factors that appear to correlate with less online and broadband usage. He also identifies supply-side reasons that may explain why some rural small businesses use broadband services less than urban small businesses, generally where broadband prices are higher than in urban areas. Other studies examine barriers to e-commerce adoption among small businesses. For example, Darch (2002) found that lack of knowledge and technological skills plus structural issues were barriers to engagement in e-commerce by small- to medium-enterprises (SMEs) within the food industry in Australia.

Natural Resources

Alaska's economy is heavily dependent on natural resources. The petroleum industry has broadband capacity linking its facilities in Prudhoe Bay with Valdez and Anchorage and with operations and management support elsewhere in the U.S. or overseas. Exploitation of additional petroleum reserves around the state will require communications for operations, logistics, and environmental monitoring. Similarly, the mining industry will need reliable communications to link its mine explorations and field operations with management and support in urban centers in Alaska and elsewhere in the U.S., while fisheries companies require communications from offshore to onshore canneries and supply bases in Alaska and to management and support facilities typically located in Washington State.

Broadband may also be used to deliver onsite training for employees of Alaska's natural resources industries. For example, Cardinali (2010) examines strategies to compete in petroleum industry labor provisioning and skills training, with an analysis of solutions "to better produce, assemble, distribute, and share open knowledge resources across open and interoperable networks while personalizing them for different skill gaps, personal media, and location of use."

Concerning mining, Shideler et al. (2007) found in Kentucky that broadband deployment had a positive and significant impact on the mining industry. He considers that this result is "not surprising, because the industry relies heavily on broadband technology for many of its production and communication processes, including the transmission of market prices on which production decisions are made." However, the sample size was too small for generalization.

Much of the research on ICTs and fisheries concerns the use of cellphones to enable fishermen in developing regions to find out competitive prices for their catch, just as small farmers have been able to get information on prices from urban markets for their crops, rather than relying on local middlemen (See Waverman et al., 2005). Availability of GPS is also useful for navigation. See, for example, Omar (2011). Managers of commercial fishing and seafood processors interviewed for the TERRA survey said that broadband would be useful for management and back office support, as well as for personal use by seasonal employees. These applications would also likely apply to other major natural resource industries such as mining, oil and gas, and forestry.

Sustainability

Dodd (2007) states that broadband contributes to environmental sustainability on many different levels:

> *It increases access to information, improves international accountability, provides a platform for lobby groups and concerned individuals to raise awareness, and creates new markets for sustainable products. Broadband will be central to international activity to reduce carbon emissions, manage the risk that changing environmental conditions will bring and to the growth of the clean technology industry. The application of broadband to these purposes is the true value of the infrastructure. The key to ensuring a sustainable society will be dependent on ICT developments adhering to environmental sustainability principles and committing to a 'life cycle' management approach.*

Saunders (2007) notes that access to satellite imaging and geo-positioning data accessible through broadband connections can contribute to benefits including improved water management, crop assessment, land clearing, soil erosion, salt contamination, and pollution.

Broadband is also likely to be an important component of strategies to develop ecotourism and other ecosystem services through websites and online support for reservations and logistics.

E-Government

The terms e-government and e-governance are often used interchangeably, but e-governance has a somewhat wider meaning. Dawes (2008) states that e-governance "comprises the use of information and communication technologies (ICTs) to support public services, government administration, democratic processes, and relationships among citizens, civil society, the private sector, and the state." She examines five interrelated objectives: a policy framework, enhanced public services, high-quality and cost-effective government operations, citizen engagement in democratic processes, and administrative and institutional reform. Her assessment of e-governance in U.S. states and local governments concludes that the greatest investments and progress have been made in enhanced public services and improved government operations.

At the state level, Thompson and Garbacz (2008) find that increasing the broadband network significantly reduces inefficiency in state economies. At the municipal level, Schwester (2009) states that e-government adoption is a function of financial, technical, and human resources. Holding all other factors constant, he found that municipalities with higher operating budgets, more full-time IT staff, and technical hardware are more likely to have a comprehensive e-government platform.

The Scandinavian countries have perhaps the longest experience with e-government. Flak et al. (2005) explored the factors that shape the development of municipal e-government in Norway. Their research suggests that the dominant stakeholder in development is the bureaucratic administration (rather than citizens or politicians). Administrators had a strong focus on internal efficiency and cost reduction; the majority of respondents reported cost reduction as the major driver behind e-government development. However, the researchers also identified a need for a more citizen-centric approach emphasizing the need for improving access and service quality for citizens.

In municipal e-government in Sweden, Grunden (2009) found that management also increased its focus on efficiency. However, e-government demanded new competencies of both employees and clients. She concludes that "internal and external digital divides are social consequences of the implementation of e-services."

Landsbergen (2010) addresses potential roles of social media in e-governance. He identifies several mechanisms through which social media may improve governance, and postulates that "social media increases social and digital inclusion and thereby political inclusion. It also supports the identification of new leaders and leading organizations." He concludes that "a better way to think about social media is that it merely provides a small window of opportunity, which for a short period of time, allows government to comprehensively reexamine how it does things, and thereby, provides the opportunity to change policies and procedures in a way that improves government."

Public Safety and Disaster Communications

Connectivity can be vitally important for public safety and disaster communications. Experiences with man-made and natural disasters in the U.S. ranging from terrorist attacks to floods, oil spills, and forest fires have demonstrated the need for telecommunications networks that are robust and interconnected. Thus, research on broadband connectivity and public safety primarily concerns technical issues such as interconnection of various dedicated networks and technological innovations, primarily in wireless that could augment existing networks. See, for example, Peha (2006) and Hallahan and Peha (2010).

An example of adaptations for disaster communications that could be useful in Alaska is the dual use of technology. "During peaceful times, dual-use technology, such as a mobile phone, operates as an everyday personal communications device, but during an emergency it transforms into an information sensor and disseminator. This overcomes aversion to using different communications equipment during a crisis and eliminates the time lag caused by government agencies collecting, processing, and distributing crisis-related data" (Underwood, 2010).

The California Institute for Telecommunications and Information Technology (Calit2) has developed a peer-to-peer incident notification system that allows people to collect and relay information about events, such as wildfires and traffic accidents, to first responders and the general public using mobile phones. "The notification system is available in California's major cities and is based on speech recognition, allowing commuters to call in and report incidents, or call in and listen about events that could disrupt their travel…. Conversely, the system can notify all users of an incident via a voice call or text message." (Underwood, 2010) The developers note that unlike traditional disaster management systems that are inflexible and constrained by capacity, the peer-to-peer system can scale to deliver real-time information during a disaster, as there is no single channel of information and no single point of information control.

Conclusion

The research reviewed above indicates that it will be difficult to predict macrolevel impacts of universal access to broadband in Alaska. However, the studies do provide insights into how broadband may impact both the public and private sectors in the Alaska economy.

The bibliography contains many more studies that appear relevant for understanding the potential impact of broadband in Alaska development, along with strategies that may be needed to optimize the benefits resulting from further investment in broadband infrastructure.

The full ISER report is available at http://www.alaska.edu/files/oit/bbtaskforce/docs/2012-11-ISER_Terra-SW_Study.pdf.

Bibliography

1. ***Economic Analyses and International Organizational Studies***

Bauer, J. M., Gai, P., Kim, J., Muth, T. A. and Wildman, S. S. (2002) *Broadband: Benefits and Policy Challenges*. A Quello Center Report. Prepared for Merit Network, Inc., December 10, 2002. Accessible at: http://www.citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.110.4171&rep=rep1&type=pdf

Connected Nation. (2008) *The Economic Impact of Stimulating Broadband Nationally*. Connected Nation, Inc. Accessible at: http://www.connectednation.org/sites/default/files/the_economic_impact_of_stimulating_broadband_nationally_-_full_version.pdf

Crandall, R., Lehr, W., and Litan, R. (2009) *The Effects of Broadband Deployment on Output and Employment: A Cross-Sectional Analysis of U.S. Data*. The Brookings Institution. http://www.brookings.edu/research/papers/2007/06/labor-crandall

Czernich, Nina, Falck, Oliver, Kretschmer, Tobias and Woessmann, Ludger, (2009) "Broadband Infrastructure and Economic Growth." CESifo Working Paper Series No. 2861, December 2009. Accessible at: http://ssrn.com/abstract=1516232

Duggal, V., Saltzman, C. and Klein, L. (2007) "Infrastructure and Productivity: An Extension to Private Infrastructure and IT Productivity." *Journal of Econometrics*, Volume 140, Issue 2, pp. 485-502. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S030440760600145X

Draca, M., Sadun, R., and Van Reenen, J. (2006). "Productivity and ICT: A Review of the Evidence." CEP Discussion Paper 749, August 2006. Accessible at: http://cep.lse.ac.uk/pubs/download/dp0749.pdf

Economics and Statistics Administration, and National Telecommunications and Information Administration (NTIA). (2010) *Digital Nation: 21st Century America's Progress toward Universal Broadband Internet Access*. US Department of Commerce, February 2010. Accessible at: http://www.ntia.doc.gov/report/2010/digital-nation-21st-century-americas-progress-towards-universal-broadband-internet-acces

Federal Communications Commission. (2010) *Connecting America: The National Broadband Plan*. Washington, DC. Accessible at: http://www.broadband.gov/download-plan/

Hempell, T. (2005) "What's Spurious, What's Real? Measuring the Productivity Impacts of ICT at the Firm-level." *Empirical Economics*, Vol. 30, Issue 2, pp. 427-464. Accessible (with purchase) at: http://www.springerlink.com/content/j258711520077145/fulltext.pdf

Hoffler, F. (2007) "Costs and Benefits from Infrastructure Competition. Estimating Welfare Effects from Broadband Access Competition." *Telecommunications Policy*, Vol. 31, Issue 6, pp. 401-418. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0308596107000456

Holt, L. and Jamison, M. (2009) "Broadband and Contributions to Economic Growth: Lessons from the U.S. Experience." *Telecommunications Policy*, Vol. 33, Issues 10-11, pp. 575-581. Accessible at: http://www.itu.int/wsis/stocktaking/docs/activities/1287045684/sdarticle.pdf

International Telecommunication Union. (2012) *The State Of Broadband 2012: Achieving Digital Inclusion For All*. A Report of the U.N. Broadband Commission. Geneva: ITU. Accessible at: http://www.broadbandcommission.org/Documents/bb-annualreport2012.pdf

Jorgeson, D. (2001) "Information Technology and the American Economy." *American Economic Review*, Vol. 91, No. 1, pp. 1-33. Accessible at: http://bss.sfsu.edu/potepan/Paris/usit.pdf

Katz, R. (2012) *The Impact of Broadband on the Economy: Research to Date and Policy Issues*. An International Telecommunication Union (ITU) Broadband Report, April 2012. Accessible at: http://www.itu.int/ITU-D/treg/publications/bbreports.html

Katz, R. and Suter, S. (2009) "Estimating the Impact of the Broadband Stimulus Plan." Columbia Institute for Tele-information (CITI), Columbia Business School, working paper. Originally published February 2009; web publication July 2010. Accessible at: http://citi25.wordpress.com/raul-katz/articles-2009/2009-impact-of-broadband-stimulus/

Koutroumpis, P. (2009) "The Economic Impact of Broadband on Growth: A Simultaneous Approach." *Telecommunications Policy*, Vol. 33, Issue 9, pp. 471-475. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0308596109000767

Lehr, W. and Lichtenberg, F. (1999) "Information Technology and Its Impact on Productivity: Firm-level Evidence from Government and Private Data Sources, 1977-1993." *Canadian Journal of Economics*, Vol. 32, Issue 2, Special Issue on Service Sector Productivity and the Productivity Paradox, April 1999, pp. 335-362. Accessible at: http://www.csls.ca/journals/sisspp/v32n2_05.pdf.

Lehr, W., Osorio, C., Gillett, S., and Sirbu, M. (2005) "Measuring Broadband's Economic Impact," *Broadband Properties Magazine*, Vol. 25, No. 12, December 2005, pp. 12-25. Accessible at: http://www.broadbandproperties.com/2005issues/dec05issues/Measuring%20Broadband%20Eco%20Impact,%20Lehr,%20Gilett,%20Sirbu.pdf

Lehr, W., and Smith-Grieco, T., (2009). *Measurement and Assessment of Broadband Availability*. A Report prepared for John Adams Innovation Institute at the Massachusetts Technology Collaborative. Accessible at: http://people.csail.mit.edu/wlehr/Lehr-Papers_files/LehrJan09%20bb%20availability.pdf

Oliner, S. and Sichel, D. (2000) "The Resurgence of Growth in the Late 1990's: Is Information Technology the Story?" *Journal of Economic Perspectives*, Vol. 14, No. 4, Fall 2000, pp. 3-22. Accessible at: http://www.aeaweb.org/articles.php?doi=10.1257/jep.14.4.3

Organization for Economic Co-operation and Development (OECD) (2011) *OECD Communications Outlook 2011*. July 2011. Paris: OECD. Accessible (with purchase) at: http://www.oecd.org/sti/broadbandandtelecom/oecdcommunicationsoutlook2011.htm

Organization for Economic Co-operation and Development (OECD) (2011) *OECD Guide to Measuring the Information Society 2011*. August 2011. Paris: OECD. Accessible (with purchase) at: www.oecd.org/sti/measuring-infoeconomy/guide

Roeller, L. and Waverman, L. (2001) "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach." *The American Economic Review*, Vol. 91, Issue 4, pp. 909-923. Accessible (with log in) at: http://www.jstor.org/stable/pdfplus/2677818.pdf?acceptTC=true

Thompson, H. G., and Garbacz, C. (2008). "Broadband impacts on state GDP: Direct and Indirect Impacts." Paper presented at the 17th Biennial Conference on International Telecommunications Society (ITS), held June 24 - 27 2008. Accessible at: http://www.canavents.com/its2008/abstracts/62.pdf

Wallsten, S. (2009). *Measuring the Effectiveness of the Broadband Stimulus Plan. The Economists' Voice*, Vol. 6, Issue 6, May 2009, pp. 1-3. Accessible at: http://www.degruyter.com/view/j/ev.2009.6.6/ev.2009.6.6.1570/ev.2009.6.6.1570.xml?format=INT

2. Rural and Regional Development

Chan, Y., Hassanein, H., Ivus, O., Middleton, C., Murray, E., Taha, A.-E., Wood, K., Benecki, L., Dixon, J., Khodakarami, F., Teboul, J., and Wasteneys, C. (2011) *Broadband Strategic Research and Impact Analysis: Development of a Partnership and Evaluation Framework for Assessing the Social and Economic Impacts of Provincial Broadband Investments*. Report prepared for the Ontario Ministry of Government Services. Kingston, Ontario: Monieson Centre, Queen's School of Business. http://business.queensu.ca/centres/monieson/research/docs/Final%20report%20Broadband

Collins, J., & Wellman, B. (2010). "Small Town in the Internet Society: Chapleau Is No Longer an Island." *The American Behavioral Scientist*, Vol. 53, Issue 9, pp. 1344-1366. Accessible at: http://homes.chass.utoronto.ca/~wellman/publications/chapleau/Small_Town_in_Internet_Society.pdf

Dabson, B. and Keller, J. (2008). *Rural Broadband*. A Rural Policy Research Institute (RUPRI) Policy Brief, December 8, 2008. Accessible at: http://www.rupri.org/Forms/RuralBroadbandFinal.pdf

Ford, G.S., and Koutsky, T. (2005). "Broadband and Economic Development: A Municipal Case Study from Florida." *Review of Urban and Regional Development Studies*, Vol. 17, Issue 3, pp. 216-229. Accessible at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=925973

Galloway, L. (2007). "Can Broadband Access Rescue the Rural Economy?" *Journal of Small Business and Enterprise Development*, Vol. 14, Issue 4, pp. 641-653. Accessible (with purchase) at: http://www.emeraldinsight.com/journals.htm?articleid=1636472

Henderson, J. (2002). "Building the Rural Economy through High-Growth Entrepreneurs." *Economic Review – Federal Reserve Bank of Kansas City*, Vol. 87, No. 3, 3rd Quarter 2002, pp. 45-70. Accessible at: http://www.kc.frb.org/Publicat/econrev/Pdf/3q02hend.pdf

Hudson, H. E. (2006). *From Rural Village to Global Village: Telecommunications for Development in the Information Age*. New York: Routledge.

Hudson, Heather E. (2011). "Rural Broadband: Strategies and Lessons from North America." *Intermedia*, Vol. 39, Issue 2, May 2011, pp. 12-19. Accessible at: http://www.iser.uaa.alaska.edu/Publications/IntermediaVol39No2NorthAmericabroadband.pdf

Irshad, H. (2009). "Broadband: An Effective Tool for Rural Development." Rural Development Division, Government of Alberta. Accessible at: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/csi12871

Kandilov, I. and Renkow, M. (2010). "Infrastructure Investment and Rural Economic Development: and Evaluation of USDA's Broadband Loan Program." *Growth and Change*, Vol. 41, No. 2, June 2010, pp. 165-191. Accessible (with log in) at: http://onlinelibrary.wiley.com/doi/10.1111/j.1468-2257.2010.00524.x/abstract; an alternative version, originally presented at the North Carolina State University's (NCSU's) Agriculture Economics Workshop (Fall 2009), is accessible at http://www.ag-econ.ncsu.edu/fall09_schedule.html

Kolko, J. (2010). *Does Broadband Boost Local Economic Development?* Public Policy Institute of California. Accessible at: http://www.ppic.org/main/publication.asp?i=866

LaRose, R., Strover, S., Gregg, J. L., Straubhaar, J. (2011). "The impact of rural broadband development: Lessons from a natural field experiment." *Government Information Quarterly*, Vol. 28, Issue 1, January 2011, pp. 91-100. Accessible at: http://www.sciencedirect.com/science/article/pii/S0740624X10001036

Shideler, D., Badasyan, N., and Taylor, L. (2007) "The Economic Impact of Broadband Deployment in Kentucky." *The Federal Reserve Bank of St. Louis: Regional Economic Development*, Vol. 3, No. 2, pp. 88-118. Accessible at: http://research.stlouisfed.org/publications/red/2007/02/Shideler.pdf

Stenberg, P, Morehart, M., Vogel, S., Cromartie, J., Breneman, V., and Brown, D. (2009) *Broadband Internet's Value for Rural America*. US Department of Agriculture, Economic Research Service, Economic Report Number 78, August 2009, 70 pp. Accessible at: http://www.ers.usda.gov/publications/err-economic-research-report/err78.aspx

Taylor Warwick Consulting Ltd. (2010). *Accelerating Broadband Enablement in Rural Alberta*. Alberta Economic Development Authority, Sustainable and Regional Development Committee, April 2010. Accessible at: https://aeda.alberta.ca/reportsandstudies/aedastudies/Documents/FINAL%20AEDA%20BROADBAND%20REPORT.pdf

Van Gaasbeck, K. A. (2008). "A Rising Tide: Measuring the Economic Effects of Broadband Use across California." *The Social Science Journal*, Vol. 45, Issue 4, pp. 691-699. Accessible at: http://www.sciencedirect.com/science/article/pii/S0362331908000955

Whitacre, B. (2010). "The Diffusion of Internet Technologies to Rural Communities: A Portrait of Broadband Supply and Demand." *The American Behavioral Scientist*, Vol. 53, Issue 9, May 2010, pp. 1283-1303. Accessible at: http://abs.sagepub.com/content/53/9/1283

Zachary P. Neal, (2010). "From Central Places to Network Bases: A Transition in the U.S. Urban Hierarchy, 1900–2000," *City & Community*, Vol. 10, Issue 1, first published online August 2010, pp. 49-75. Accessible at: http://onlinelibrary.wiley.com/doi/10.1111/j.1540-6040.2010.01340.x/abstract

3. Alaska and the North

Alexander, C. J., Adamson, A., Daborn, G., Houston, J., and Tootoo, V. (2009). "Inuit Cyberspace: The Struggle for Access for Inuit Qaujimajatuqangit." *Journal of Canadian Studies*, Vol. 43, No. 2, pp. 220-249. Accessible at: http://muse.jhu.edu/journals/journal_of_canadian_studies/v043/43.2.alexander.pdf

Beck, R., Eisner, W., Hinkel, K., Pesanti, H., Ellis, B., Beiswenger, E., Parker, W., Treadwell, M., Smith, S., Krogh, L., Hansen, K. G., and Peskov, V. (2005). "Nutarniq: Uniting the Arctic Community with a Wireless Arctic Network for Circumpolar Communications." *Polar Geography*, Vol. 29, Issue 1, pp. 43-78. Accessible (with purchase) at: http://www.tandfonline.com/doi/abs/10.1080/789610165

Bjarnason, T., Gudmundsson, B. and Olafsson, K. (2011). "Towards a Digital Adolescent Society? The Social Structure of the Icelandic Adolescent Blogosphere." *New Media & Society*, Vol. 13, No. 4, pp. 645-662. Accessible (with log in) at: http://nms.sagepub.com/content/13/4/645

Canadian Radio-Television and Telecommunications Commission (CRTC). (2011). *Telecom Regulatory Policy CRTC 2011-291: Obligation to Serve and Other Matters*. Ottawa: 3 May 2011. Available at: http://www.crtc.gc.ca/eng/archive/2011/2011-291.htm

Connect Alaska. (2011). "Broadband and Business: Leveraging Technology in Alaska to Stimulate Economic Growth." An Alaska Business White Paper. Washington, DC: Connected Nation. Accessible at: http://www.connectak.org/_documents/AK_BizWhitePaper_FINAL.pdf

Dinero, S. C., Mariotz, E. and Bhagat, P. (2007) "Bridging the Technology Gap: Building a Development Model for Rural Alaska." *Journal of Cultural Geography*, Vol. 24, Issue 2. Accessible (with log in) at: http://www.tandfonline.com/doi/abs/10.1080/08873630709478211#preview

Fiser, A. and Clement, A. (2009) "K-Net and Canadian Aboriginal Communities." IEEE Technology and Society Magazine, Vol. 28, Issue 2, Summer 2009, pp. 23-33. Accessible (with log in) at: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5072379&tag=1

Fiser, A., Clement, A. and Walmark, B. (2006) "The K-Net Development Process: A Model for First Nations Broadband Community Networks." Canadian Research Alliance for Community Innovation and Networking (CRACIN), Working Paper No. 2006-12. Accessible at: http://archive.iprp.ischool.utoronto.ca/cracin/publications/pdfs/WorkingPapers/CRACIN%20Working%20Paper%20No%2012.pdf

Garrick, R. "Elder examines Aboriginal Artifacts via Videoconference." Keewaytinook Okimakanak Research Institute (KORI) research article, first published online April 14, 2008. Accessible at: http://research.knet.ca/node/194

Gratton, M.F. and O'Donnell, S. (2011) "Communication Technologies for Focus Groups with Remote Communities: A Case Study of Research with First Nations in Canada." *Qualitative Research*, Vol. 11, No. 2, April 2011, pp. 159-175. Accessible (with log in) at: http://qrj.sagepub.com/content/11/2/159.abstract

GwaiiTel (2006). "GwaiiTel Launches High Speed Internet Services in Haida Gwaii." November 28, 2006. Accessible at: http://www.gwaiitel.com/newscontd.html

Hudson, H. E. (2011) "Digital Diversity: Broadband and Indigenous Populations in Alaska" *Journal of Information Policy*, Vol. 1, pp. 378-393. Accessible at: jip.vmhost.psu.edu/ojs/index.php/jip/article/download/42/37; an alternative version is accessible at: http://www.iser.uaa.alaska.edu/Publications/DigitalDiversityAlaskaHudson.pdf

Hudson, H. E. (2011) "Connectivity across the Arctic: A Comparative Analysis of Broadband Access in Alaska, Northern Canada, and Greenland." Paper presented at the International Congress of Arctic Social Sciences, Akureyri, Iceland, June 22nd – 26th 2011. Accessible at: www.iser.uaa.alaska.edu

Hudson, H. E., and Pittman, T. S. (1999) "From Northern Village to Global Village: Rural Communications in Alaska." *Pacific Telecommunications Review*, Vol. 21, No. 2.

Imaituk Inc. (2011) *A Matter of Survival: Arctic Communications Infrastructure in the21st Century*. Arctic Communications Infrastructure Assessment (ACIA) Report. Prepared for the Northern Communications and Information Systems Working Group, April 30, 2011. Canadian Northern Economic Development Agency (CanNor). Accessible at: www.aciareport.ca

Institute of Social and Economic Research. (2011). *The Evolution of Telecommunications in Alaska: From Bush Telephones to Broadband*. Symposium organized by the Institute of Social and Economic Research (ISER), University of Alaska Anchorage, June 2011. PowerPoint presentation slides and a video of the proceedings. Accessible at: http://www.iser.uaa.alaska.edu/Projects/akbroadbandproj/aktelesymposium.php

K-Net. "Keewaytinook Okimakanak." www.knet.ca

McDowell Group. (2009). *Alaska Geographic Differential Study*. Prepared for the Alaska State Department of Administration. Accessible at: http://doa.alaska.gov/dop/gds/home.html

McKeon, L. and Ganley, M. (2011) "The North's Digital Leaders." *Up Here Business*, 076 February 2011. Accessible at: http://www.upherebusiness.ca/node/491

McMahon, R. (2011). "The Institutional Development of Indigenous Broadband Infrastructure in Canada and the United States: Two Paths to 'Digital Self-Determination.'" *Canadian Journal of Communication*. Vol. 36, Issue 1, January 2011, pp. 115-140. Accessible at: http://www.cjc-online.ca/index.php/journal/article/view/2372/2227

Mignone, J. and Henley, H. (2009). "Impact of Information and Communication Technology on Social Capital in Aboriginal Communities in Canada." *Journal of Information, Information Technology, and Organizations*, Vol. 4, pp. 127-145. Accessible at: http://umanitoba.ca/faculties/human_ecology/departments/fss/media/5.pdf

Nunavut Broadband Development Corporation (NBDC). (2012). "Nunavut Schools to Benefit from Improved Internet Access." News release, first published online February 14, 2012. Accessible at: http://www.nunavut-broadband.ca/PDF/2012_Feb14_NR_Classroom_Connect_ENG.pdf

O'Donnell, S., Perley, S., Walmark, B., Burton, K., Beaton, B., and Sark, A. (2007). *Community-based broadband organizations and video communications for remote and rural First Nations in Canada*. Proceedings of the Community Informatics Research Network (CIRN) Conference, Prato, Italy, November 2007. Accessible at: http://www.susanodonnell.info/downloads/2007-VideoCom-CIRN.pdf

Qiniq. 2012. "Qiniq Network Gets Boost from Broadband Canada Program." Available at: http://www.qiniq.com/node/121

Salter Global Consulting Inc. "Nunavut Fibre Optic Feasibility Study." (2012) Prepared for the Nunavut Broadband Development Corporation (NBDC). Accessible at: http://www.nunavut-broadband.ca/fiberOpticReport.html

Southwest Alaska Municipal Conference (SWAMC). (2010) *Southwest Alaska Broadband Strategy: "Planning for Opportunity."* Draft published October 6th, 2010. Accessible at: http://www.swamc.org/files/Southwest%20Alaska%20Broadband%20Strategy_DRAFT.pdf

U.S. Department of Agriculture. (2010). *Alaska Forum on Jobs and Economic Development*.: Final Report. Palmer, Alaska: USDA Service Center. Accessible at: http://www.fsa.usda.gov/Internet/FSA_File/usda_rept_final_02152010.pdf

Warf, B. (2011) "Contours, Contrasts, and Contradictions of the Arctic Internet." *Polar Geography*, Vol. 34, Issue 3, September 2011, pp. 193-208. Accessible (with log in) at: http://www.tandfonline.com/doi/abs/10.1080/1088937X.2011.589012

Windeyer, C. "Nunavut Internet Users lag far behind Canada." *Nunatsiaq Online* news update, first published online November 18, 2010. Accessible at: http://www.nunatsiaqonline.ca/stories/article/87678_nunavut_internet_users_lag_far_behind_canada/

4. Adoption

Baller, J., and Lide, C. (2008) *Capturing the Promise of Broadband in NC and America*. Ballard Herbst Law Group. Accessible at: http://www.baller.com/pdfs/BallerHerbst_e-NC_White_Paper.pdf

Beard, T. R., Ford, G. S., Spiwak, L. J. and Stern, M. L. (2010) "The Broadband Adoption Index: Improving Measurements and Comparisons of Broadband Deployment and Adoption." *Federal Communications Law Journal*, Vol. 62, Issue 2, March 2010, pp. 343-402. Accessible at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1626363

Benkler, Y. (2010). *Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from around the World*. Berkman Centre for Internet and Society, Harvard University. Accessible at: http://cyber.law.harvard.edu/pubrelease/broadband/

California Broadband Taskforce. (2008) *Final Report*. California Technology Agency. Accessible at: http://www.cio.ca.gov/broadband/taskforcereport/default.asp

Cooper, M. (2010). *The challenge of digital exclusion in America: A review of the social science literature and its implications for the U.S. National Broadband Plan*. Consumer Federation of America. Accessible at: http://apps.fcc.gov/ecfs/document/view?id=7020384062

CostQuest Associates, Inc. (2010) *Broadband Assessment Model*. Prepared as part of the Federal Communications Commission's National Broadband Plan. Last updated March 2010. Accessible at: http://download.broadband.gov/plan/fcc-omnibus-broadband-initiative-%28obi%29-working-reports-series-technical-paper-broadband-assessment-model.pdf

Dailey, D., Bryne, A., Powell, A., Karaganis J., and Chung, J. (2010) Broadband Adoption in Low-Income Communities. Social Science Research Council. Report commissioned by the Federal Communications Commission as part of the National Broadband Plan. Accessible at: http://www.ssrc.org/publications/view/1EB76F62-C720-DF11-9D32-001CC477EC70/

Daly, A. (2005). "Bridging the Digital Divide: The Role of Community Online Access Centres in Indigenous Communities." The Centre for Aboriginal Economic Policy Research (CAEPR), Australian National University College of Arts and Social Sciences, Discussion Paper 273. Accessible at: http://caepr.anu.edu.au/Publications/DP/2005DP273.php

Economics and Statistics Administration, and National Telecommunications and Information Administration. (2010) *Exploring the Digital Nation: Home Broadband Internet Adoption in the United States*. US Department of Commerce, November 2010. Accessible at: http://www.ntia.doc.gov/report/2010/exploring-digital-nation-home-broadband-internet-adoption-united-states

Economics and Statistics Administration, and National Telecommunications and Information Administration. (2011) *Exploring the Digital Nation: Computer and Internet Use at Home*. U.S. Department of Commerce, November 2011. Accessible at: http://www.ntia.doc.gov/report/2011/exploring-digital-nation-computer-and-internet-use-home

e-NC Authority. (2009) *Capturing the Promise: A 10-Year Action Plan using Broadband Internet to Increase North Carolina's Competitiveness and Sustainability in the Global Economy.* North Carolina Department of Commerce.

Federal Communications Commission. (2009) *National Broadband Plan Workshop: Diversity and Civil Rights Issues in Broadband Deployment and Adoption*. Accessible at: http://www.broadband.gov/ws_diversity.html

Forman, C. (2005). "The Corporate Digital Divide: Determinants of Internet Adoption." *Management Science*, Vol. 51, Issue 4, April 2005, pp. 641-654. Accessible (with log in) at: http://www.jstor.org/stable/20110358

Gilroy, A. A. (2011) *Access to Broadband Networks: The Net Neutrality Debate*. Congressional Research Service. April 25, 2011. Accessible at: https://opencrs.com/document/R40616/

Goldstein, M. (2006) *Challenges to Assessing and Improving Telecommunications for Native Americans on Tribal Lands*. Testimony given before the U.S. Senate: Committee on Commerce, Science, and Transportation. United States Government Accountability Office, March 2006. Accessible at: http://www.gao.gov/products/GAO-06-513T.

Greenstein, S. and Prince, J. (2008). "The Diffusion of the Internet and the Geography of the Digital Divide in the United States." In *The Oxford Handbook of Information and Communication Technologies*, Mansell, R., Avgerou, C., Quah, D., and Silverstone, R. eds). New York: Oxford University Press USA. Accessible at: http://www.kellogg.northwestern.edu/faculty/greenstein/images/htm/Research/chapters/Internet%20geography2.pdf;

Horrigan, J. B. (2009) *Broadband Adoption and Use in America*. The Federal Communications Commission Omnibus Broadband Initiative (OBI) Working Paper Series No. 1. Accessible at: http://online.wsj.com/public/resources/documents/FCCSurvey.pdf

International Telecommunication Union (ITU). (2007) *Digital Opportunity Index*. Geneva: ITU. Accessible at: http://www.itu.int/ITU-D/ict/doi/index.html

LaRose, R., Gregg, J.L., Strover, S., Straubhaar, J., and Carpenter, S. (2007). "Closing the Rural Broadband Gap: Promoting Adoption of the Internet in Rural America." *Telecommunications Policy*, Vol. 31, Issue 6-7, July 2007, pp. 359-373. Accessible (with log in) at: http://www.sciencedirect.com/science/article/pii/S0308596107000444

Minnesota Ultra High-Speed Broadband Taskforce. (2010) *Minnesota Ultra High-Speed Broadband Plan*. Minnesota Department of Commerce. Accessible at: http://www.ultra-high-speed-mn.org/CM/Custom/UHS%20Broadband%20Report_Full.pdf

Nafus, D. and Mainwaring, S. D. (2010) *Rural Broadband Expansion in the United States: Citizen Perception as a Social Process*. Paper presented at the Technology Policy Research Conference (TPRC), Washington, D.C., August 15, 2010. Accessible at: http://ssrn.com/abstract=1989653

New York State Council for Universal Broadband. (2009) *Connecting New York to the World for Sustainable Adoption: New York State Universal Broadband Strategic Roadmap*. New York State CIO and New York State Office for Technology. Accessible at: http://www.cio.ny.gov/assets/documents/Final_Broadband_Strategy_June2009.pdf

Noriega, R., McGovern, C., Joshi, D. and Walker, J. (2011) *Late to the Party: How New Broadband Subscribers Compare to Early Adopters*. Paper presented at the Technology Policy Research Conference (TPRC), Arlington, VA, September 23 – 25, 2011. Connected Nation, Inc. Accessible at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1995130

Peha, J. M. (2008) *Bringing Broadband to Unserved Communities*. Washington, DC: Brookings Institution. Accessible at: http://www.itu.int/wsis/stocktaking/docs/activities/1287154309/Carnegie_Mellon_University.pdf

Smith, Aaron. (2010) *Home Broadband 2010*. Washington, DC: Pew Internet and American Life Project, Pew Research Center. Accessible at: http://www.pewinternet.org/Reports/2010/Home-Broadband-2010.aspx

Strategic Networks Group. (2011) *Regional Analysis Report*. North Carolina Department of Commerce.

State of Alaska, Office of Management and Budget. (2009) *Response to NTIA, USDA RUS Joint Request for Information*. April 9, 2009. Accessible at: www.ntia.doc.gov/legacy/broadbandgrants/comments/71B4.doc

Waverman, L. , Meschi, M., and Fuss, M. (2005) "The Impact of Telecoms on Economic Growth in Developing Countries." In *Africa: The Impact of Mobile Phones*. Vodafone Policy Paper Series, March, 2005. Accessible at: http://info.worldbank.org/etools/docs/library/152872/Vodafone%20Survey.pdf

Wood, L. E. (2008) "Rural broadband: The Provider Matters." *Telecommunications Policy*, Vol. 32, Issue 5, June 2008, pp. 326-339. Accessible (with log in) at: http://www.sciencedirect.com/science/article/pii/S0308596107000845

World Bank (2009). *Information and Communications for Development 2009: Extending Reach and Increasing Impact*. Washington, DC: World Bank. Accessible at: http://issuu.com/world.bank.publications/docs/9780821376058

World Bank (2012). *Information and Communications for Development 2012: Maximizing Mobile*. Washington, DC: World Bank. Accessible at: http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/IC4D-2012-Report.pdf

5. Sector Studies

Education, Research, and Libraries

Alaska State Commission on Research (SCoR). "To Build a Fire: A Plan for the Future of Science and Technology in Alaska." Draft Report, July 3, 2012.

Bernard, R. M., Abrami, P. C., Lou Y., et al. (2004) "How Does Distance Education Compare With Classroom Instruction? A Meta-Analysis of the Empirical Literature." *Review of Educational Research*, Vol. 74, No. 3, Fall 2004, pp. 379-439. Accessible (with log in) at: http://rer.sagepub.com/content/74/3/379

Bertot, J. C. (2009) "Public Access Technologies in Public Libraries: Effects and Implications." *Information Technology and Libraries*, Vol. 28, No. 2, June 2009, pp. 81-91. Accessible at: https://acrl.org/ala/mgrps/divs/lita/publications/ital/28/2/bertot.pdf

Bertot, J. C., McClure, C. R., and Jaeger, P. T. (2005) "The E-rate Program and Libraries and Library Consortia." *Information Technology and Libraries*, Vol. 24, No. 2, June 2005, pp. 57-67. Accessible at: https://acrl.org/ala/mgrps/divs/lita/publications/ital/24/2/jaeger.pdf

Bertot, J. C., McClure, C. R., and Jaeger, P. T. (2008) "The Impacts of Free Public Internet Access on Public Library Patrons and Communities." *The Library Quarterly*, Vol. 78, No. 3, July 2008, pp. 285-301. Accessible at: http://mcclure.ii.fsu.edu/publications/2008/The impacts of free public Internet access on public library patrons and communities.pdf

Greaves, T. W., Hayes, J., Wilson, L., Gielniak, M., and Peterson, E. L. (2012) *Revolutionizing Education through Technology: The Project RED Roadmap for Transformation*. Eugene, OR and Washington, DC: International Society for Technology in Education. Accessible at: http://www.projectred.org/images/books/ISTE_Book.pdf
Synopsis at: http://www.projectred.org/

Daniel, J., West, P., D'Antoni, S., and Uvalić-Trumbić, S. (2005). "ICTs in Education: Can Digital Dividend Replace Digital Divide?" Paper presented at the Witfor Conference, Gaborone, Botswana, September 1, 2005. Accessible at: http://www.col.org/resources/speeches/2005presentations/Pages/2005-09-01a.aspx

Hahn, S. and Lehman, L. (2006) "The Half-Million-Square-Miles Campus: University of Alaska Fairbanks Off-Campus Library Services." *Journal of Library and Information Services in Distance Learning* Vol. 2, Issue 3. Accessible (with purchase) at: http://www.tandfonline.com/doi/abs/10.1300/J192v02n03_02

Hoffman, J., Bertot, J. C., and Davis D. M. (2012) "Libraries Connect Communities: Public Library Funding and Technology Access Study 2011-2012." Digital supplement of *American Libraries*, Summer 2012. Accessible at: http://viewer.zmags.com/publication/4673a369

Hudson, H. E. (2009) "The Future of the E-Rate: U.S. Universal Service Fund Support for Public Access and Social Services." In … *and Communications for All: An Agenda for a New Administration*, A. Schejter (ed.). Lanham, MD: Lexington Books.

Mandel, L. H., Bishop, B. W., McClure, C. R., Bertot, J. C., and Jaeger, P. T. (2010) "Broadband for Public Libraries: Importance, Issues, and Research Needs." Government Information Quarterly, Vol. 27, Issue 3, July 2010, pp. 280–291. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0740624X10000250

Information Policy and Access Center (IPAC). (2012) *Public Libraries and Broadband: Issues Brief*. Part of the Public Library Funding and Technology Access Study, IPAC, University of Maryland, published online May 31, 2012. Accessible at: www.plinternetsurvey.org/sites/default/images/Briefs/BroadbandBrief2012May312012-1.pdf

Page, G. A., and Hill, M. (2008) "Information, Communication, and Educational Technologies in Rural Alaska." *New Directions for Adult and Continuing Education*, Vol. 2008, Issue 117, Spring 2008, pp. 59-70. Accessible (with log in) at: http://onlinelibrary.wiley.com/doi/10.1002/ace.286/abstract

Perraton, H. (2010) *Teacher Education: The Role of Open and Distance Learning*. Vancouver, BC: Commonwealth of Learning. Accessible at: www.col.org/resources/publications/Pages/detail.aspx?PID=333

Schafft, K. A., Alter, T. R., and Bridger, J. C. (2006). "Bringing the Community Along: A Case Study of a School District's Information Technology Rural Development Initiative." *Journal of Research in Rural Education*, Vol. 21, No. 8, July 17, 2006, pp. 1-10. Accessible at: http://www.jrre.psu.edu/articles/21-8.pdf

Visser, M. and Ball, M. A. (2010) "The Middle Mile: The Role of the Public Library in Ensuring Access to Broadband." *Information Technology and Libraries*, Vol. 29, No. 4, December 2010, pp. 187-194. Accessible at: https://acrl.org/ala/mgrps/divs/lita/publications/ital/29/4/visser.pdf

Health Care

Alaska Federal Health Care Access Network (AFHCAN). Alaska Native Tribal Health Consortium. See: www.afhcan.org

Bahensky, J. A., Jaana, M., and Ward, M. M. (2008) "Health Care Information Technology in Rural America: Electronic Medical Record Adoption Status in Meeting the National Agenda." *The Journal of Rural Health*, Vol. 24, Issue 2, Spring 2008, pp. 101-105. Accessible (with log in) at: http://onlinelibrary.wiley.com/doi/10.1111/j.1748-0361.2008.00145.x/abstract

Ferguson, S., and Kokesh, J. (2011) *What Works: Outcomes Data from AFHCAN and ANTHC Telehealth: An 8 Year Retrospective*. Alaska Native Tribal Health Consortium. PDF copy of PowerPoint presentation accessible at: http://www.iser.uaa.alaska.edu/Projects/akbroadbandproj/telecomsymposium/FergusonAFHCAN%20-%20What%20Works.pdf

Ferguson, S., Kokesh, J., Patricoski, C., Hofstetter, P., and Hogge, N. (2009) *Impact of Store-and-Forward Telehealth in Alaska: A Seven Year Retrospective; Impact and Experiences from Seven Years of Utilization within the AFHCAN System*. Alaska Native Tribal Health Consortium. Accessible at: http://www.hss.state.ak.us/healthcommission/meetings/200908/pdf/AFHCAN_impact.pdf

Hovenga, E.J.S., Kidd, M.R., Garge, S., Hullin, C. and Cossio, L. (2010) *Health Informatics: An Overview*. Amsterdam, the Netherlands: IOS Press. Accessible (with purchase) at: http://www.booksonline.iospress.nl/Content/View.aspx?piid=16108.

Hudson, H. E. (2007) "Rural Telemedicine: Lessons from Alaska for Developing Regions." *Journal of eHealth Technology and Application*, Vol. 5, No. 3, September 2007, pp. 460-467. Accessible (with purchase) at: http://online.liebertpub.com/doi/abs/10.1089/tmj.2005.11.460?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed

Hudson, H. E., and Parker, E. B. (1973) "Medical Communication in Alaska by Satellite." *New England Journal of Medicine*, Vol. 289, Issue 25, December 20, 1973, pp. 1351-1356. Accessible (with purchase) at: http://www.nejm.org/doi/full/10.1056/NEJM197312202892506

Jennett, P. ,Yeo, M., Scott, R., Hebert, M. and Teo, W. (2005) "Delivery of Rural and Remote Health Care via a Broadband Internet Protocol Network - Views of Potential Users." *Journal of Telemedicine and Telecare*, Vol. 11, No. 8, pp. 419-424. Accessible (with purchase) at: http://jtt.rsmjournals.com/content/11/8/419.short

Keselman, A., Logan, R., Smith, C. A., Leroy, G., and Zeng-Treitler, Q. (2008) "Developing Informatics Tools and Strategies for Consumer-centered Health Communication." *Journal of the American Medical Informatics Association*, Vol. 15, Issue 4, July-August 2008, pp. 473-483. Accessible at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2442255/

Mair, F., Peterkin, G., Laing, A., Ferguson, J., and Fraser, S. (2008) "Feasibility of a Telemedicine 'Booth' for supporting Remote Care in Scotland." *Journal of Telemedicine and Telecare*, Vol. 14, Issue 3, April 2008, pp. 127-129. Accessible (with purchase) at: http://jtt.rsmjournals.com/content/14/3/127.abstract

McNickle, Michelle. "5 ways Telemedicine can boost Care in Rural Communities." Health Care IT News, October 13, 2011. Available at: http://www.healthcareitnews.com/news/5-ways-telemedicine-can-boost-care-rural-

Neuberger, N. (2007). "Advancing Healthcare Through Broadband: Opening Up a World of Possibilities." A White Paper for the Internet Innovation Alliance. Accessible at: http://geiselmed.dartmouth.edu/nhtp/pdf/advancing_healthcare_broadband.pdf

Schwager, H.A. (2010) "A Home Telepsychiatry in Arizona and Alaska (USA)." *European Psychiatry*, Volume 25, Supplement 1, pg. 1700. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0924933810716795

Sequist, T. D., Cullen, T., Hays, H., Taualii, M. M., Simon, S. R., and Bates, D. W. (2007) "Implementation and Use of an Electronic Health Record within the Indian Health Service." *Journal of the American Medical Informatics Association*. Vol. 14, Issue 2, March–April 2007, pp. 191-197. Accessible at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2213460/?tool=pmcentrez&rendertype=abstract

Siedlecki, J. B. (2004) *Telehealth in Rural/Remote Yukon Communities: Five Case Studies*. Ph.D. Dissertation, Department of Community Health Sciences, University of Calgary. Accessible (with log in) at: http://search.proquest.com.proxy.consortiumlibrary.org/docview/305360568

Smith, A. C., Bensink, M., Armfield, N., Stillman, J., and Caffery, L. (2005) "Telemedicine and Rural Health Care Applications." *Journal of Postgraduate Medicine*, Vol. 51, Issue 4, pp. 286-293. Accessible at: http://www.jpgmonline.com/article.asp?issn=0022-3859;year=2005;volume=51;issue=4;spage=286;epage=293;aulast=Smith

Tracy, J., Rheuban, K., Waters, R. J., DeVany, M., and Whitten, P. (2008) "Critical Steps to Scaling Telehealth for National Reform." *Telemedicine and e-Health*, Vol. 14, Issue 9, November 2008, pp. 990-994. Accessible (with purchase) at: http://online.liebertpub.com/doi/abs/10.1089/tmj.2008.0125

Whitacre, B. (2011) "Estimating the Economic Impact of Telemedicine in a Rural Community." *Agricultural and Resource Economics Review*, Vol. 40, Issue 2, August 2011, pp. 172-183. Accessible at: http://ageconsearch.umn.edu/bitstream/117770/2/ARER%2040-2%20pp%20172-183%20Whitacre.pdf

Whitten, P., Mair, F., Haycox, A., May, T., and Hellmich, S. (2002) "Systematic Review of Cost Effectiveness Studies of Telemedicine Interventions." *British Medical Journal*, Vol. 324, Issue 7351, June 15, 2002, pp. 1434-1437. Accessible at: http://www.bmj.com/content/324/7351/1434.pdf%2Bhtml

Yellowlees, P., Burke, M. M., Marks, S. L., Hilty, D. M., and Shore, J. H. (2008) "Emergency Telepsychiatry." *Journal of Telemedicine and Telecare*, Vol. 14, No. 6, pp. 277-281. Accessible (with purchase) at: http://jtt.rsmjournals.com/content/14/6/277.abstract

E-Commerce, Rural Business, Natural Resources:

Bai, Y., and Liyanage, J. P. (2010). "Evaluating and Optimising Integrated Planning in Complex Production Assets: Learnings from Offshore Petroleum Industry." *International Journal of Decision Sciences, Risk and Management*, Vol. 2, No. 3-4/2010, pp. 252-275. Accessible (with purchase) at: http://www.inderscience.com/info/inarticle.php?artid=37486

Barkai, A. and Henninger, H. (2010). "The Introduction of Elog Technology to the Fishing Industry, a Case Study: Ground Fish Sector Project." Oceans 2010 conference, Sept 20-23, 2010. Accessible at: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5663993

Bharadwaj, P. N., and Soni, R. G. (2007). "E-Commerce Usage and Perception of E-Commerce Issues among Small Firms: Results and Implications from an Empirical Study." *Journal of Small Business Management*, Vol. 45, Issue 4, October 2007, pages 501-521. Accessible (with purchase) at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1008091&

Cardinali, F. (2010). "The PEARL Initiative: Producing, Sharing and Managing blended Online, Mobile and Instructor Led Learning Content within the Oil Industry." Paper presented at the SPE Annual Technical Conference and Exhibition, Florence, Italy, September 20 – 22, 2010. Accessible (with purchase) at: http://www.onepetro.org/mslib/servlet/onepetropreview?id=SPE-135588-MS

Darch, H., and Lucas, T. (2002). "Training as an e-Commerce Enabler." *Journal of Workplace Learning*, Vol. 14, Issue 4, pp. 148-155. Accessible (with purchase) at: http://www.emeraldinsight.com/journals.htm?articleid=882253

Dodd, T. 2007. "The Role of Broadband in the Quest for Environmental Sustainability." *Telecommunications Journal of Australia*, Vol. 57, No. 2/3, pp. 28.1 to 28.12. Accessible at: tja.org.au/index.php/tja/article/view/162/174

Kim, J. B. (2006) "Determinants of B2B Adoption in South Korean Fishery Wholesale Firms: An Exploratory Study." *Reviews in Fisheries Science*, Vol. 14, Issue 3, pp. 285-301. Accessible (with purchase) at: http://www.tandfonline.com/doi/abs/10.1080/10641260600816510#preview

Pociask, S. B. (2005) *Broadband Use by Rural Small Businesses*. Small Business Research Summary, No. 269, December 2005. U.S. Small Business Administration, Office of Advocacy. Accessible at: http://www.marketingtechie.com/articles/SmallBusiness%20-%20Dec20.pdf

Ruiz-Molina, M., Gil-Saura, I., and Moliner-Velazquez, B. (2010). "Information and Communication Technologies in Rural Hotels." *International Journal of Sustainable Economy*, Vol. 2, Issue 1, pp. 1-15. Accessible (with purchase) at: http://www.inderscience.com/offer.php?id=29938

Saunders, R. (2007) "Broadband and the Environment." *Telecommunications Journal of Australia*, Vol. 57, No. 2/3, pp. 27.1 to 27.12. Accessible at: http://tja.org.au/index.php/tja/article/view/161

Omar, S. Z., Abu Hassan, M., Azril, H., Shaffril, M., Bolong, J., and D'Silva, J. L. (2011) "Information and Communication Technology for Fisheries Industry Development in Malaysia." *African Journal of Agricultural Research*, Vol. 6, No. 17, September 5th, 2011, pp. 4166-4176. Accessible at: http://www.academicjournals.org/ajar/abstracts/abstracts/abstracts2011/5%20Sept/Omar%20et%20al.htm

E-Government

Chatfield, A. T. (2009) "Public Service Reform through e-Government: a Case Study of 'e-Tax' in Japan." *The Electronic Journal of E-Government*, Vol. 7, Issue 2, April 2009, pp. 135-146. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=168

Dawes, Sharon S. (2009) "Governance in the Digital Age: A Research and Action Framework for an Uncertain Future." Government Information Quarterly, Vol. 26, Issue 2, April 2009, pp. 257–264. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0740624X08001500

Dawes, S. S. (2008) "The Evolution and Continuing Challenges of E-Governance." Public Administration Review, Vol. 68, Issue Supplement s1, December 2008, pp. S86–S102. Accessible at: http://faculty.cbpp.uaa.alaska.edu/afgjp/PADM610/Evolution and continuing challenges of E-Governance.pdf

Evans, D. and Yen, D. C. (2006) "E-Government: Evolving Relationship of Citizens and Government, Domestic, and International Development." *Government Information Quarterly*, Vol. 23, Issue 2, pp. 207–235. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0740624X05000936

Flak, L., Olsen, D., and Wolcott, P. (2005) "Local e-Government in Norway." *Scandinavian Journal of Information Systems*, Vol. 17, Issue 2, pp. 41-84. Accessible at: http://unpan1.un.org/intradoc/groups/public/documents/UN-OTHER/UNPAN032095.pdf

Freitas, F., Candeias Jr., Z., and Stuckenschmidt, H. (2010) "A new Usage for Semantic Technologies for eGovernment: Checking Official Documents Consistency." *The Electronic Journal of E-Government*, Vol. 8, Issue 2, December 2010, pp. 120-133. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=203

Garson, G. D. (2006) Public Information Technology and E-Governance: Managing the Virtual State. Raleigh, NC: Jones and Bartlett Publishers.

Grunden, K. (2009) "A Social Perspective on Implementation of e-Government: A Longitudinal Study at the County Administration of Sweden." *The Electronic Journal of E-Government*, Vol. 7, Issue 1, January 2009, pp. 49-60. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=180

Landsbergen, D. (2010) "Government as Part of the Revolution: Using Social Media to Achieve Public Goals." *The Electronic Journal of E-Government*, Vol. 8, Issue 2, December 2010, pp. 134-146. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=204

McNeal, R., Hale, K. and Dotterweich, L. (2008) "Citizen–Government Interaction and the Internet: Expectations and Accomplishments in Contact, Quality, and Trust." *Journal of Information Technology & Politics*, Vol. 5, No. 2, pp. 213-229. Accessible (with purchase) at: http://www.tandfonline.com/doi/abs/10.1080/19331680802298298

Miori, V. and Russo, D. (2011) "Integrating Online and Traditional Involvement in Participatory Budgeting." *The Electronic Journal of E-Government*, Vol. 9, Issue 1, January 2011, pp. 41-57. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=222

Nygren, K. G. (2009) "e-Governmentality: On Electronic Administration in Local Government." *The Electronic Journal of E-Government*, Vol. 7, Issue 1, January 2009, pp. 39-48. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=179

Ochara-Muganda, N. and Van Belle, J.-P. (2010) "The Link between the Conceptualization of eGovernment and its Perceived Impacts: An Exploratory Empirical Study in Kenya." *The Electronic Journal of E-Government*, Vol. 8, Issue 2, December 2010, pp. 161-174. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=206

Pina, Vicente, Torres, Lourdes; and Acerete, Basilio. (2007). "Are ICTs Promoting Government Accountability? A Comparative Analysis of E-governance Developments in 19 OECD Countries." *Critical Perspectives on Accounting*. Volume 18, Issue 5, July 2007, pp. 583-602. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S1045235406000220

Schwester, R. W. (2009). "Examining the Barriers to e-Government Adoption." *The Electronic Journal of E-Government*, Vol. 7, Issue 1, January 2009, pp. 113-122. Accessible at: http://www.ejeg.com/issue/download.html?idArticle=184

Welch, E. W., Hinnant, C. C., and Moon, M. J. (2005). "Linking Citizen Satisfaction with E-Government and Trust in Government." *Journal of Public Administration Research and Theory*, Vol. 15, Issue 3, July 2005, pp. 371-391. Accessible (with purchase) at: http://jpart.oxfordjournals.org/content/15/3/371.short

Public Safety and Disaster Communications

Hallahan R. and Peha, J. M. (2008). "Quantifying the Costs of a Nationwide Broadband Public Safety Wireless Network." Paper presented at the 36th Telecommunications Policy Research Conference (TPRC), Arlington, VA, September 26th – 28th, 2008. Accessible at: http://users.ece.cmu.edu/~peha/costs_of_public_safety_network.pdf

Hallahan R. and Peha, J. M. (2010). "Policies for Public Safety Use of Commercial Wireless Networks." Presented at the 38th Telecommunications Policy Research Conference, Oct. 2010. Accessible at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1989600&

Jaeger, P. T., Shneiderman, B., Fleischmann, K. R., Preece, J. Qua, Y., and Wua, P. F. (2007). "Community Response Grids: E-Government, Social Networks, and Effective Emergency Management." *Telecommunications Policy*, Vol. 31, Issue 10, pp. 592–604. Accessible (with purchase) at: http://www.sciencedirect.com/science/article/pii/S0308596107000699

Kirby, P. (2007). "Public Safety, Industry Differ on Broadband Network Plan." *Telecommunications Reports*, Vol. 73, Issue 6, Mar 2007, pp. 37-40. Accessible (with purchase) through: http://www.tr.com/newsletters/tr/

Ochoa, S.F., Neyem, A., Pino, J. A. and Borges, M.R.S. (2007). "Supporting Group Decision Making and Coordination in Urban Disasters Relief Efforts." *Journal of Decision Systems*, Vol. 16, Issue 2, pp. 143-172. Accessible (with purchase) at: http://www.tandfonline.com/doi/abs/10.3166/jds.16.143-172#preview

Peha, J. M. (2006). "From TV to Public Safety: The Need for Fundamental Reform in Public Safety Spectrum and Communications Policy." *New America Foundation*, Working Paper #15. Accessible at: http://www.newamerica.net/files/WorkingPaper15_TVtoPublicSafety_Peha_FINAL.pdf

Tanner, A., Friedman, D.B., Koskan, A., and Barr, D. (2009). "Disaster Communication on the Internet: A Focus on Mobilizing Information." *Journal of Health Communication: International Perspectives*, Vol. 14, Issue 8, pp. 741-755. Accessible (with purchase) at: http://www.tandfonline.com/doi/abs/10.1080/10810730903295542#preview

Underwood, S. (2010). "Improving Disaster Management." *Communications of the ACM*, Vol. 53 Issue 2, February 2010, pp. 18-20. Accessible at: http://cacm.acm.org/magazines/2010/2/69366-improving-disaster-management/fulltext

WWW.AKBROADBANDTASKFORCE.COM