Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Connect America Fund	)	WC Docket No. 10-90
	)	
A National Broadband Plan for Our Future	)	GN Docket No. 09-51
	)	
Establishing Just and Reasonable Rates for Local Exchange Carriers	)	WC Docket No. 07-135
	)	
High-Cost Universal Service Support	)	WC Docket No. 05-337
	)	
Developing an Unified Intercarrier Compensation Regime	)	CC Docket No. 01-92
	)	
Federal-State Joint Board on Universal Service	)	CC Docket No. 96-45
	)	
Lifeline and Link-Up	)	WC Docket No. 03-109

COMMENTS OF VIASAT, INC.

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Summary

ViaSat supports the Commission's desire to facilitate the extension of broadband service to areas that currently are "unserved." As a leading provider of satellite broadband services in the United States, ViaSat agrees that "[u]biquitous broadband infrastructure has become crucial to our nation's economic development and civic life," and that "the benefits of broadband grow when all areas of the country are connected." Next-generation satellite broadband services—like those that ViaSat will begin providing later this year—would make a substantial contribution in achieving the Commission's goals. Among other things, satellite broadband providers can extend service to unserved areas at higher speeds, with better quality, at lower cost, and on a more accelerated timetable, than many terrestrial alternatives.

Yet, the *NPRM* proposes frameworks that would selectively exclude satellite providers from full and direct participation in "competitive" reverse auctions under the Connect America Fund ("CAF")—contrary to the requirements of Section 254 of the Act and long-standing Commission precedent. While the *NPRM* advocates developing an approach to the CAF that is competitively-neutral, technology-agnostic, and market-based, the proposed CAF structure falls short in all three respects.

As shown in the attached report prepared by Dr. Charles L. Jackson, and the attached economic analysis prepared by Jonathan Orszag and Bryan Keating of Compass Lexecon, excluding satellite broadband providers in this fashion ***would unnecessarily inflate the CAF by as much as <u>21 billion dollars</u>.***

The Orszag/Keating paper explains that excluding full and direct broadband satellite participation in the reverse auctions would (i) eliminate the competitive pressures that low-cost, high-quality satellite broadband service otherwise would bring to bear in reverse auctions, and (ii) deny the economies of scale needed for satellite providers to extend coverage to additional "extremely high-cost" unserved areas—ultimately forcing the

Commission to subsidize much more expensive terrestrial providers in those areas. In contrast:

- Allowing satellite broadband providers to participate fully and directly in all reverse auctions would lower significantly the CAF's funding requirements while generating more attractive build-out and service commitments in general;

- Allowing such participation would generate economies of scale, create incentives for satellite broadband providers to invest in new satellites, and otherwise benefit consumers in both "unserved" and "underserved" areas; and

- Allowing satellite broadband providers to partner with other providers and directly bid in CAF reverse auctions as "prime" bidders would generate significant efficiencies that would lower the CAF funding burden—efficiencies that would not obtain if satellite were relegated to a secondary role, as a subcontractor of a terrestrial service provider.

Dr. Jackson addresses the factual underpinning of assertions in the *NPRM* that the selective exclusion of satellite broadband providers from the CAF is warranted due to "limited" satellite capacity and that satellite broadband service is economical only for a subset of "unserved" areas that are "extremely high-cost." As Dr. Jackson explains, the study upon which the *NPRM* relies is flawed because it is based on biased standards applied only to satellite (but not terrestrial) providers. That study, entitled "*The Broadband Availability Gap, OBI Technical Paper No. 1*," suffers from three serious errors with respect to satellite services. In particular OBI Technical Paper No. 1:

- Incorrectly estimates the cost of next-generation satellite broadband service by extrapolating from market prices *today*, without adjusting for the fact that today's prices reflect high system demand (from the scarcity of capacity) that will be relieved by the launch of two new broadband satellites by next year.

- Makes no allowance for continuing technological progress in commercial satellite communications—a field that has seen enormous progress in the past. This is like assuming that personal wireless devices in 2020 would be no better than they are today—despite all historical trends to the contrary.

- Fails to account for additional satellites beyond the two next-generation broadband satellites that will be launched in 2011 and 2012. This is like assuming that terrestrial wireless providers would build a few cell sites and then simply stop, even though they could increase capacity (and profits) by continuing to expand their capacity.

As Dr. Jackson's report explains, there are ample spectrum and technical resources that satellite providers could exploit to extend broadband service to millions of unserved households—even considering the increased bandwidth demands expected over the next decade. More specifically, his analysis shows that satellite providers could deploy enough capacity by 2020 to serve over 6 million households, even after taking into account the expected increase in usage of capacity predicted by the Commission.

Furthermore, Dr. Jackson's analysis shows that satellite is the least expensive way to serve about 3.3 million additional housing units—at least 47% of the broadband gap, for about $1.8 billion in subsidy. In contrast, serving these same housing units by terrestrial technologies would require support of $23 billion, based on the Commission's data. The 3.3 million housing units where satellite broadband is the most cost-effective alternative is over ***thirteen times*** the 250,000 "extremely high-cost" households identified in the *NPRM* as suitable for satellite broadband service. Notably, many of these additional housing units are located in the approximately 40% of the United States that is outside of the footprints of the two next-generation satellites that have been publicly-announced to date. If satellite broadband providers are excluded from the CAF, there may be no business case for them to expand their coverage and capacity to serve these additional high-cost areas.

The Commission should correct course to ensure that it can leverage all of the substantial benefits that next-generation satellite broadband can deliver. Satellite broadband services will soon offer a high-quality, truly competitive alternative to terrestrial broadband services (*e.g.*, ranging from 4/1 Mbps to 12/3 Mbps), and thus will provide a vehicle for delivering broadband to millions of currently unserved households. Satellite providers should be permitted to participate fully and directly in all phases of the CAF, on a truly technology-neutral basis, and to receive support wherever they are the most cost-efficient broadband providers. In addition, the Commission should take measures to ensure that the "broadband" definitions, standards, and obligations established under the CAF are competitively neutral.

In particular, they should be flexible enough to encompass all technologies, including "hybrid" solutions (combining multiple technologies), as well as partnering and similar arrangements between different service providers. The identity of the direct bidder should be irrelevant, and satellite broadband providers should be able to participate in reverse auctions as "prime" bidders, just like any terrestrial broadband provider would be able to participate. The Commission also should streamline the ability of "nationwide" providers—including satellite broadband providers—to receive support quickly by establishing a *federal* process through which such operators could establish their "ETC" status.

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COMMENTS OF VIASAT, INC.

ViaSat, Inc. ("ViaSat") hereby responds to the *Notice of Proposed Rulemaking* ("*NPRM*") adopted by the Commission on February 8, 2011 in the above-referenced proceeding. In the *NPRM*, the Commission proposes to "fundamentally modernize" the Universal Service Fund ("USF") by creating a new Connect America Fund ("CAF"), "eliminating waste and inefficiency [in existing high-cost support mechanisms,] and reorienting USF . . . to meet the nation's broadband availability challenge . . . ."[1] The Commission seeks comment on a wide array of issues related to this effort.

As a leading provider of satellite broadband services in the United States, ViaSat appreciates the opportunity to comment on these issues. As explained below, satellite broadband services will soon offer a high-quality, truly competitive alternative to terrestrial broadband services, and thus will provide a vehicle for delivering broadband to millions of currently unserved households. Satellite broadband providers should play a significant role in the Commission's efforts to expand broadband availability, and should be permitted to compete for available funding in the same manner and on the same terms as other providers, on a truly technology-neutral basis.

I. INTRODUCTION

ViaSat applauds the Commission's efforts to reform existing high-cost support mechanisms, and to ensure that all Americans have access to critical broadband services at affordable prices. ViaSat agrees with the Commission that "[u]biquitous broadband infrastructure has become crucial to our nation's economic development and civic life," and that "the benefits of broadband grow when all areas of the country are connected."[2] In fact, broadband services enable a variety of modes of communication that have become more important to many consumers than "plain old" voice service.[3] For this reason, ViaSat supports the Commission's efforts to develop and implement a CAF mechanism that is competitively and technologically neutral, and that will distribute limited funding to the provider(s) that can extend broadband service to "unserved" households most efficiently.

ViaSat also appreciates the Commission's recognition of the valuable contribution that satellite broadband services will make in providing a high-quality service to currently "unserved" households on a cost-efficient basis. As the just-released *Broadband Satellite Markets* report by Northern Sky Research explains, the ViaSat-1 satellite scheduled for launch this summer will "start the transformation of satellite broadband access services" from its current state "to one where it should be able to readily compete with terrestrial

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1 *NPRM* ¶ 1.

2 *Id.* ¶ 3.

3 *See, e.g.*, FCC Commissioner Mignon L. Clyburn, *Robust Competition in the Wireless Industry is the Key to a Successful Marketplace*, Prepared Remarks at the National Conference for Media Reform, Boston, MA (Apr. 8, 2011) ("Did you ever think that we would develop and opt for a more convenient way of casually communicating other than talking? This is the new reality, and this country has embraced it wholeheartedly.").

broadband not only in rural areas without any option, but also in underserved markets where terrestrial offers like aDSL becomes [sic] hindered by the distance from the DSLAM."[4] That report forecasts that the North American subscriber base for satellite broadband *will triple* from about 1.1 million in 2010 to about 3.3 million in 2020.[5]

The *NPRM* correctly recognizes that satellite technologies could be used to extend broadband services to unserved households.[6] However, while the *NPRM* observes that satellite networks are "ideally suited" to extend broadband service to households in the highest-cost areas of the country,[7] the *NPRM* fails to acknowledge the much bigger role that the marketplace anticipates for satellite broadband.

The *NPRM* significantly underestimates the potential contribution that satellite technologies could make in extending broadband to "unserved" households, and in bringing competitive pressures to bear on other broadband providers, both within and outside of the CAF mechanism. Most problematic is the *NPRM*'s suggestion that satellite providers should play only a limited role in the CAF appears based on the erroneous assumption that satellite capacity is "limited." Satellite providers can have ample capacity with which to extend broadband service to millions of households that currently are *unserved*, while also serving their existing customer base, and providing a positive, competitive force in *underserved* areas. In addition, satellite providers can deploy enough capacity to economically provide high-quality broadband services at speeds that meet or exceed the 4/1 Mbps standard proposed by the Commission (*e.g.*, 8/2 Mbps, 12/3 Mbps). However, if satellite broadband is excluded from direct participation in the CAF mechanism, there may be no business case for

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4 Northern Sky Research, *Broadband Satellite Markets: A Worldwide Analysis of Industry Trends and Market Forecasts from 2010-2020*, at 3-13 (10th Ed., Apr. 2011).

5 *Id.* at 3-14.

6 *NPRM* ¶ 104.

7 *Id.* ¶ 133.

satellite providers to extend service to those unserved Americans. Allowing full participation by satellite broadband also would reduce significantly the size of the CAF fund, and the resulting burden on consumers, who will fund the CAF through surcharges on their monthly service bills.

Accordingly, ViaSat urges the Commission to ensure that satellite broadband providers can participate fully and directly in the CAF, and on an equal footing with other providers. In particular, the CAF should allow satellite broadband providers to play a substantial role in closing the broadband availability gap by taking advantage of the cost-effectiveness of satellite broadband technologies, and particularly the soon-to-be-available next generation of satellites that will offer significant improvements in quality and speed, and increasing economies of scale. The Commission also should:

(i) Ensure that the definitions, standards, and obligations adopted by and imposed on broadband providers are sufficiently flexible to account for variations among technologies and network architectures, and changes in consumer demand;

(ii) Adopt rules that are flexible enough to encompass all technologies, including "hybrid" solutions (combining multiple technologies), as well as partnering and similar arrangements between different service providers;

(iii) Make the identity of the direct bidder irrelevant, and allow satellite broadband providers to participate as a "prime" bidder, just like any terrestrial broadband provider would be able to participate; and

(iv) Provide a mechanism for satellite and other "nationwide" broadband providers to seek designation as eligible telecommunications carriers ("ETCs") at the federal level in order to facilitate competition and also speed the provision of service to the public.

These steps would ensure that the Commission can fully leverage the capabilities of satellite technology, and facilitate the efficient and effective distribution of CAF funding, as well as the ability of satellite broadband providers like ViaSat to provide high-quality and affordable broadband service to the currently "unserved" and "underserved" public.

II. BACKGROUND

ViaSat is a leading provider of advanced satellite and other wireless communications solutions and services, and has leveraged its success in developing complex communication systems and equipment for the U.S. government and commercial customers to develop and implement end-to-end communications solutions for a wide array of applications. The company's portfolio of products and services, combined with its ability to effectively cross-deploy technologies between different industry segments and across different geographic markets, provides ViaSat with a strong foundation to sustain and enhance its leadership in advanced communications and networking technologies—including broadband technologies.

More recently, ViaSat has evolved into a leading provider of broadband Internet access services in the United States. Through its WildBlue service, ViaSat is one of the top-20 broadband ISPs in the country, providing satellite broadband to over 400,000 U.S. homes. In just a few months, ViaSat will launch ViaSat-1—the highest-capacity broadband satellite in the world. ViaSat-1 is designed to drive a quantum shift in the speed and quality of satellite broadband service, while simultaneously increasing available capacity and ultimately allowing satellite broadband providers to serve millions of additional customers. Specifically, ViaSat-1 will feature an innovative spacecraft design yielding capacity that is approximately 50-100 times greater than traditional Ku-band FSS satellites, and approximately 10-15 times greater than the highest capacity Ka-band satellites that serve the United States today.

Thus, later this year, ViaSat will start transforming the nature of today's satellite-delivered broadband service by offering the highest speeds and best quality of broadband service ever offered by a satellite platform, at prices and performance levels that are competitive with many terrestrial alternatives (as calculated using a busy-hour loading rate ("BHOL") consistent with that used by the Commission in calculating the broadband availability gap). In short, ViaSat-1 will make satellite broadband service an attractive option for many consumers, and transform the industry from its modest beginnings.

Critically, ViaSat-1 is the first in a series of innovations that will enable ViaSat to provide broadband service to the millions of U.S. homes that are difficult or expensive to reach by cable or fiber networks. Going forward, ViaSat plans to design a series of broadband satellites with even more advanced technical characteristics and even more compelling bandwidth economics. At the same time, ViaSat is and will remain a communications solutions provider, willing to develop and implement whatever technologies or network architectures are best-suited to the needs of its customer or to overcome a particular challenge.

ViaSat's next-generation satellite broadband solutions will provide a high-quality broadband experience, capable of supporting not only the 4/1 Mbps service envisioned by the *NPRM*, but also service at even higher speeds (*e.g.*, 8/2 Mbps and 12/3 Mbps). These satellite broadband solutions also will have the extremely important benefit of low jitter (*i.e.*, fluctuations in latency). Therefore, satellite solutions will be ideal for the most popular Internet applications (that also consume the most Internet bandwidth)—including video streaming, peer-to-peer networking, e-mail, and web surfing.[8] They also will be ideal for the Internet activities on which users spend the most time, including accessing social networking sites, e-mail, and web portals, and general browsing.[9] Increasingly popular applications such as distance learning, telecommuting, and telehealth applications (which require higher speeds and low jitter) also will work extremely well over satellite. In addition, satellite broadband networks will be able to support real-time communications—whether by

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8 *See Cisco Visual Networking Index: Forecast and Methodology, 2009-2014*, at 10 (Jun. 2, 2010).

9 *See* Nielsen Online Research, *What Americans Do Online* (Aug. 2, 2010).

text, voice, or video. In fact, the ability to provide a "return link" of 3 Mbps or more will allow satellite broadband (unlike DSL) to ensure that high-definition video can be transmitted in both directions during a video conference.

ViaSat-1 and the other next-generation broadband satellites that will commence service in the near term will cover only about 60% of the geographic area of the United States, using beams that are fixed during the construction process, such that they cannot be repositioned or repointed. These spot beams are pre-focused on those areas because they are the areas of greatest demand, with the highest population density, where capacity is needed most.

No next-generation broadband satellites are under construction, or publicly announced, that will provide coverage of the remaining 40% of the country—including large areas that are among the most-expensive to serve via terrestrial infrastructure. Thus, while the initial two next-generation broadband satellites will have sufficient capacity to provide excellent service to households throughout their footprints, those satellites will be unable to provide such service to households in other areas (for obvious reasons). Fortunately, the Commission can ensure that the benefits of satellite broadband can be extended to all parts of the United States, over time, by structuring the CAF to allow satellite broadband providers to participate fully and directly, on an equal footing with other providers. Allowing such participation would support the business case for, and allow ViaSat and other satellite broadband providers to attract the capital investment necessary to, launch additional satellites to cover the remaining portions of the United States.[10]

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[10] It would be extremely difficult for satellite providers to raise such capital if the CAF skews competition by precluding full and direct satellite participation while at the same time subsidizing less-efficient, higher-cost terrestrial competitors. This would not only harm consumers, but also could damage the ability of satellite providers to

III. THE *NPRM* UNDERESTIMATES THE POTENTIAL CONTRIBUTION OF SATELLITE BROADBAND PROVIDERS

A. The Proposed Structure of the CAF Is Not Competitively or Technologically Neutral.

While ViaSat appreciates the *NPRM*'s recognition of the valuable role that satellite providers can play in extending broadband service to households that currently are unserved, ViaSat believes that the *NPRM* significantly underestimates the potential contribution of satellite broadband providers. In particular, the *NPRM* proposes to give satellite providers only a limited role in the CAF, ostensibly due to the "limited" nature of satellite capacity. However, as detailed below and in the attached report of Dr. Charles L. Jackson, the assertion that satellite capacity will be "limited" is wrong as a matter of fact.[11] Moreover, the assertion in the *NPRM* is based on assumptions that are far from competitively or technologically neutral. Thus, any attempt to limit the participation of satellite providers in the CAF would be "arbitrary and capricious," and contrary to the Communications Act, as amended (the "Act").

In the *USF First Report and Order*, the Commission adopted "competitive neutrality"—defined as the state in which "universal service support mechanisms and rules neither unfairly advantage nor disadvantage one provider over another, and neither unfairly favor nor disfavor one technology over another"—as a guiding principle for the administration of the USF. The Commission committed to adopting rules to minimize competitive and technological bias, and recognized that such rules would "facilitate a market-

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provide service for critical applications—including first responder, public safety, law enforcement, and military applications.

11 *See* Dr. Charles L. Jackson, *Satellite Service Can Help to Effectively Close the Broadband Gap* (Apr. 18, 2011), attached as Exhibit A hereto ("Jackson Paper").

based process whereby each user comes to be served by the most efficient technology and carrier."[12]

The Commission also recognized that the principle of competitive neutrality clearly demands an inclusive approach to participation in USF funding mechanisms. Thus, the Commission determined that providers using *any* technology—including satellite technologies—are eligible for USF support as long as they meet the statutory criteria set forth in Section 214(e)(1) of the Act.[13] More specifically, the Commission found that "the principles of competitive and technological neutrality" demand that "*non-landline telecommunications providers should be eligible to receive universal service support even though their local calls are completed via satellite*."[14] The Commission also concluded that "any wholesale exclusion of a class of carriers"—*e.g.*, satellite providers—"by the Commission would be inconsistent with the language of the statute and the pro-competitive goals of the 1996 Act."[15]

While the *NPRM* claims that its proposals are "competitively neutral because [they] will not unfairly advantage one provider over another or one technology over another,"[16] even a cursory review of those proposals reveals that this is not the case. Perhaps most glaringly, the *NPRM* proposes to exclude satellite providers from participating in Phase I of the CAF, without even attempting to evaluate the *bona fides* of a satellite bidder, the merits of its bid, or its ability to serve the public interest by extending broadband service to households that currently lack it. This is precisely the sort of "wholesale exclusion" that the

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[12] *Federal-State Joint Board on Universal Service*, Report and Order, 12 FCC Rcd 8776, at ¶ 48 (1997) ("*USF First Report and Order*").

[13] *Id.* ¶ 145.

[14] *Federal-State Joint Board on Universal Service*, Fourth Order on Reconsideration, 13 FCC Rcd 5318, at ¶ 10 (1997).

[15] *USF First Report and Order* ¶ 145.

[16] *NPRM* ¶ 82.

Commission has concluded is inconsistent with statutory requirements applicable to and basic principles of USF.

The *NPRM* suggests that satellite capacity is "limited," in an apparent attempt to justify the discriminatory treatment of satellite broadband providers.[17] In fact, and as discussed below, satellite broadband providers will have ample capacity to make a significant contribution in closing the broadband availability gap, at lower cost than available terrestrial alternatives.[18] The *NPRM* reaches a contrary conclusion only after making assumptions and applying standards that are different for satellite networks than their terrestrial counterparts. For example:

- The *NPRM* faults satellite providers for having "limited" capacity, but ignores the fact that other providers, including terrestrial wireline and wireless providers, are similarly "limited" today. As the Commission is well-aware, *no* provider—terrestrial or satellite—currently possesses infrastructure or capacity sufficient to extend broadband service to all "unserved" areas, or has near-term plans to provide such capacity in the absence of CAF funding. Indeed, the *NPRM* assumes that there is no business case to serve these areas, justifying the creation of the CAF in the first place.[19] Yet, the Commission faults satellite networks alone for not having existing or near-term capacity already in place.
- The *NPRM* concludes that satellite capacity is "limited" because "existing and expected satellite capacity will [not] be sufficient to serve *all unserved housing units in the United States* over the next few years at projected usage

17 *Id.* ¶ 272.

18 *See* Section III.B, *infra*.

19 *See, e.g.*, *NPRM* ¶ 10 n.16.

levels."[20] Notably, though, the *NPRM* does not judge the adequacy of *any* other technology or provider by its potential to serve *all* currently unserved households in the next few years.[21] In fact, the *NPRM* acknowledges that terrestrial technologies simply will be unable to serve many high-cost areas, even with CAF support, for both technical and economic reasons.[22]

- The *NPRM* readily assumes that terrestrial providers will expand their infrastructure and capacity to serve "unserved" areas using funding provided by the CAF. However, the *NPRM* fails to make the equivalent assumption with respect to satellite networks. In fact, the *NPRM* assumes *no* growth in satellite capacity over time.[23] This creates a self-fulfilling prophecy; because the *NPRM* incorrectly assumes that satellite providers will have fixed capacity, the *NPRM* would deny them the funding that would allow them to expand capacity.

- The *NPRM* ignores widespread industry recognition that terrestrial networks (*e.g.,* mobile wireless networks) will face serious obstacles in expanding their

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20 *Id.* ¶ 272 (emphasis supplied).

21 That being said, given a properly structured CAF, satellite broadband providers would be able to serve a large portion of the approximately 7 million housing units identified as "unserved" by the Commission.

22 *See NPRM* ¶ 134 ("[W]e acknowledge that in some areas, because of terrain or density, recipients may have a higher percentage of housing units that can only be served by broadband with different performance metrics, while in other areas, a recipient may be able to serve all housing units with broadband that meets the Commission-adopted metrics.").

23 The *NPRM* relies on analysis presented in OBI Technical Paper No. 1, which apparently credits only the satellite capacity available on ViaSat-1 and Jupiter broadband satellites that have been described in press releases from ViaSat and Hughes, respectively. *See* Omnibus Broadband Initiative, *The Broadband Availability Gap*, at 90 (Apr. 2010). No other company or technology was evaluated in this fashion. In any event, ViaSat, Hughes, and other companies are actively working on plans for additional next-generation broadband satellites, public disclosure of which would be premature. In this sense, satellite broadband providers are no different than their terrestrial counterparts.

ability to serve currently "unserved" households. For example, there is widespread recognition that 4G technologies will be unable to overcome technical constraints currently faced by terrestrial wireline providers.[24] Yet, the *NPRM* ignores these challenges.

In light of the double-standard employed by the *NPRM*, faulting satellite networks for having "limited" existing capacity is flatly inconsistent with the principal of competitive neutrality.[25]

At bottom, the only question of relevance in examining the potential contribution of satellite broadband providers is whether those providers would make a meaningful contribution in extending broadband service to households that currently are "unserved." Because satellite broadband providers will be able to make such a contribution, it would be "arbitrary and capricious," and inconsistent with the Act, to treat satellite broadband providers differently than their terrestrial counterparts.[26]

B. Satellite Broadband Providers Will Be Able To Serve Many Millions of "Unserved" Households.

1. The *NPRM* relies on a study that is flawed in asserting that satellite capacity is "limited."

As noted above, the *NPRM* proposes to give satellite providers only a limited role in the CAF, due to the "limited" nature of satellite capacity. As explained in the attached report of Dr. Charles L. Jackson, and entitled *Satellite Service Can Help to Effectively Close the Broadband Gap*, the study upon which the *NPRM* relies (OBI Technical Paper No. 1) is

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24 *S*ee David Goldman, *4G Won't Solve 3G's Problems* (Mar. 29, 2011), *at* http://money.cnn.com/2011/03/29/technology/4g_lte/.

25 To the extent that the Commission has concerns about satellite capacity—which are dispelled in the following section—the correct solution is to craft CAF mechanisms that require *all* bidders to demonstrate that they will have sufficient capacity to serve the relevant geographic area covered by their bids—not to summarily exclude satellite providers from any direct participation.

26 *See, e.g.*, *Motor Vehicle Mfrs. Assn. of United States, Inc. v. State Farm Mut. Automobile Ins. Co.*, 463 US 29, 46-57 (1983) (unjustified inconsistency supports a

flawed because it is based on biased standards applied only to satellite (but not terrestrial) providers.[27] As a result, the *NPRM* perpetuates misstatements in the *National Broadband Plan,* while depriving the proposed CAF of a basis in reasoned decision-making.[28]

More specifically, OBI Technical Paper No. 1 suffers from three serious analytical errors with respect to satellite broadband services. In particular:

- It estimates the cost of next-generation satellite broadband service by extrapolating from market prices *today*, without adjusting for the fact that today's prices reflect current congestion that will be resolved by the launch of two new satellites by next year. This is like using the price of corn during a drought to estimate the price of corn during a banner year for produce.[29]
- It makes no allowance for continuing technological progress in satellite communications—a field that has seen enormous progress in the past. This is

finding of "arbitrary and capricious" rulemaking sufficient to allow rejection of an agency's rules).

27 *See* Jackson Paper at 11-12.

28 The *National Broadband Plan* mischaracterizes the capabilities and cost of satellite broadband networks, in many cases by citing sources that contradict the relevant assertion in the *Plan*. For example, to support the proposition that "satellite capacity can meet only a small portion of broadband demand in unserved areas for the foreseeable future," the *Plan* cites an article by Northern Sky Research that concludes that the addition of only two next-generation broadband satellites (ViaSat-1 and Jupiter) will support service to *millions* of subscribers. *See* Omnibus Broadband Initiative, *CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN*, at 137 & n.13 ("*National Broadband Plan*"); Northern Sky Research, *How Much HTS Capacity is Enough?*, *available at* http://www.talksatellite.com/Americas-A781 (last visited Apr. 18, 2011). The *Plan* also suggests that "the high fixed costs of designing, building and launching a satellite mean that satellite-based broadband is likely to be cheaper than terrestrial service only for the most expensive-to-serve areas," citing the *Atkinson Report*, even though that report does not attempt any comparative analysis of costs by provider or geographic area, and in fact notes that next-generation broadband satellites "are expected to lower the cost per bit of delivering satellite broadband service." *See National Broadband Plan* at 62 n.10; Robert C. Atkinson & Ivy E. Schultz, *Broadband In America: Where It Is And Where It Is Going (According To Broadband Service Providers)* 57 (2009) ("*Atkinson Report*").

29 *See* Jackson Paper at 11-12.

like assuming that personal computing devices in 2020 would be no better than they are today—despite all historical evidence to the contrary.[30]

- It fails to account for additional satellites beyond the two next-generation broadband satellites that will be launched in 2011 and 2012, respectively. This is like assuming that terrestrial wireless providers would build a few cell sites and then simply stop, even though they could increase capacity (and profits) by continuing to expand their capacity.[31]

Each of these errors causes the study upon which the *NPRM* relies to understate the capabilities of satellite broadband providers and overestimate the cost of satellite service. As explained in the next section, Dr. Jackson's report duplicates the same analytical model but corrects these analytical errors. By doing so, he demonstrates that under proper assumptions, satellite broadband service would provide a technically feasible and economically attractive alternative with which to close much of the broadband gap.

2. Satellite broadband providers could deploy enough capacity by 2020 to serve over 6 million households.

The suggestion in the *NPRM* that satellite broadband capacity is and will be "limited" is flatly wrong as a matter of fact. As Dr. Jackson establishes, satellite broadband operators will have sufficient capacity in 2015, using just the two next-generation satellites scheduled for launch in the next year, to provide 4/1 Mbps and better broadband service to about one million currently "unserved" households—almost quadruple the 250,000 "extremely high-cost" households that are the focus of the NPRM.[32] This calculation is based on the same, increasing end-user bandwidth demands and provisioning requirements

30 *See id.* at 5.

31 *See id.* at 6.

32 *See id.* at 7.

(*i.e.*, "BHOL" factor) assumed in OBI Technical Paper No. 1, which underlies the proposals in the NPRM.

Dr. Jackson also demonstrates that satellite broadband providers could deploy additional satellites with enough capacity to serve over 6 million households by 2020.[33] This figure accounts for the expected increase in bandwidth usage predicted by the Commission. As Dr. Jackson explains, ample opportunities exist for satellite operators to develop available technological, orbital, and spectrum resources to augment existing satellite broadband capacity.[34] ViaSat itself is planning to launch multiple broadband satellites by 2020—with overall capacity improvements beyond those on ViaSat-1. Capacity on these satellites can be focused on areas identified as "unserved" that are not within the coverage area of ViaSat-1, although it may not be practical for ViaSat to do so if the competitive marketplace becomes skewed by the adoption of the proposed CAF structure. Assuming that the CAF is ultimately structured in a technologically- and competitively-neutral manner, satellite broadband capacity should expand over time at an increasing rate, supporting increasing numbers of end users, while also keeping up with increasing bandwidth demands.

In fact, while satellite broadband is still in the earlier stages of its technology life cycle, there is every reason to anticipate that the growth of satellite broadband capacity will track or, more likely outpace, similar growth in the satellite direct-to-home ("DTH") video industry. Notably, the DTH industry expanded from one satellite serving a few million viewers, to over two dozen satellites, in just 16 years. That transformation was driven by the introduction of new Direct Broadcast Satellite ("DBS") technologies and the expanded service possibilities made possible by those technologies. In the same manner, rapid growth

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33 *See id.* at 12-13.

34 *See id.* at 5-6.

in satellite broadband capacity will be driven by the introduction of next-generation satellite broadband technologies, beginning with the launch of ViaSat-1 later this year.

As long as the CAF is structured properly—*i.e.*, in a manner that allows satellite providers to participate fully—satellite providers should be able to provide this capacity growth and savings along with a number of other benefits, including:

- **Service at significantly lower cost than terrestrial alternatives in at least 47% of the 7 million unserved housing units identified by the Commission.** As the *NPRM* recognizes, "[s]atellite service is ideally suited for serving housing units that are the most expensive to reach via terrestrial technologies, because there is little marginal cost to add a subscriber."[35] However, the *NPRM* seeks to limit satellite providers to serving only 250,000 of these "most expensive" housing units.[36] Simply stated, this approach would squander the potential cost-savings that satellite technologies could deliver. Dr. Jackson's analysis shows that satellite is the least expensive way to serve about 3.3 million additional housing units—at least 47% of the broadband gap, for about $1.8 billion in subsidy. Since terrestrial technologies would require about $23 billion to serve those same housing units, it would cost about ***thirteen times less*** to close the investment gap with satellite broadband than it would to do so with other technologies.[37] Thus, allowing satellite broadband providers to compete for CAF funding should result in a substantial overall

35 *NPRM* ¶ 133.

36 *See, e.g., id.* ¶ 424.

37 *See* Jackson Paper at 17. It bears emphasis that the calculations in Dr. Jackson's paper are provided to demonstrate the cost-effectiveness of satellite broadband, when compared with terrestrial technologies on the same terms. Of course, the amount that an individual bidder in an auction would require may depend on a variety of factors not considered by *OBI Technical Paper No. 1*, such as less than 100% adoption in a

reduction in the CAF funding burden, and the burden placed on contributing end users.

- **Service that meets or exceeds evolving standards for broadband speed and quality, and thus provides continuous closure of the "Digital Divide."** As the *NPRM* acknowledges, standards for broadband speed and quality are expected to evolve over time as consumer expectations shift.[38] As Dr. Jackson details, satellite broadband providers will be able to use expanding capacity, along with advances in technology, to offer service improvements that keep pace with, or exceed, these evolving standards.[39] Moreover, satellite broadband providers will be able to adapt their networks to those evolving standards without stranding existing infrastructure or investment, unlike their terrestrial counterparts; satellite providers can use existing satellites to provider higher-speed/higher-quality service by serving fewer subscribers using those satellites, and then launch additional satellites to provide enhanced service capabilities.

- **Service to "bypassed" households within the satellite footprint.** While the *NPRM* focuses on serving "unserved" households in high-cost areas, the *NPRM* does not address those households in generally low-cost areas that likely will remain unreached by terrestrial broadband service. These "bypassed" households are everywhere—even in areas that are densely populated and viewed as "served" today.[40] As long as these "bypassed"

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given area, subscriber churn, and actual or potential competition from other providers. A full analysis of those factors is beyond the scope of that paper.

38 *See, e.g.*, *NPRM* ¶ 312.

39 *See* Jackson Paper at 4-6.

40 *See* Comments of ViaSat, Inc., WC Docket No. 11-10, at 4-6 (Mar. 30, 2011).

households remain unserved, the objectives of the CAF, and the Commission's statutory obligations under Section 254, will be left unfulfilled. By allowing satellite broadband providers to participate fully in the CAF, the Commission would facilitate the ability of satellite broadband providers to expand the capacity available to serve these "bypassed" households—in addition to those households directly supported by the CAF.

In sum, there simply is no justification for the *NPRM*'s suggestion that satellite broadband capacity will be more "limited" than the capacity available over terrestrial networks. As such, there is no need to "ration" the use of satellite broadband capacity to ensure that it is available for the 250,000 highest-cost households. In fact, any attempt to "ration" the use of satellite capacity in this manner would be counterproductive, for the reasons set forth below.[41]

C. Allowing Satellite Broadband Providers To Participate Fully in the CAF Would Significantly Reduce the CAF Funding Burden, While Creating Significant Benefits for Competition and Consumer Welfare.

Allowing satellite broadband providers to participate fully in the CAF, on an equal footing with terrestrial providers, would yield tangible benefits for the CAF and the amount of USF support required to close the broadband availability gap. More specifically, and as discussed in the attached analysis by Jonathan Orszag and Bryan Keating of Compass Lexecon:[42]

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41 *See* Section III.C.2, *infra*.

42 *See* Jonathan Orszag and Bryan Keating, *An Analysis of the Benefits of Allowing Satellite Broadband Providers to Participate Directly in the Proposed CAF Reverse Auctions* (Apr. 18, 2011), attached as Exhibit B hereto ("Orszag/Keating Paper").

1. Allowing satellite broadband providers to participate fully and directly in any reverse auctions would lower significantly the CAF's funding requirements while generating more attractive build-out and service commitments.

Allowing full satellite participation in the CAF would increase the competitive pressures and incentives for other participants to improve their bids—*i.e.*, lower their funding requirements and/or offer more attractive build-out and service commitments. Consequently, such participation would decrease the CAF funding burden, while leading to a more efficient distribution of support and greater public benefits from limited funding—regardless of whether satellite operators win in any given area.[43] Among other things, this could obviate the need for any cap on the size of the CAF.

On the other hand, restricting the ability of satellite providers to participate directly in any reverse auction would undermine the objectives of the CAF. By eliminating certain potential bidders from directly participating in the auction, especially bidders with a low cost structure, such an approach would eliminate incentives for the remaining bidders to bid as aggressively. Critically, the pool of potential bidders in many unserved markets would be quite small, such that the exclusion of even a single satellite broadband provider that otherwise would participate would have a significant impact on bid amounts and auction strategy. Consequently, such exclusion would be expected to result in significantly higher bids in the aggregate, and a reduction in both funding efficiency and the public benefits from the CAF—along with an increase in aggregate burden placed on contributing consumers.[44]

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43 *Id.* ¶ 14.

44 *Id.* ¶ 18 ("This approach would lead to higher bids from the remaining bidders, all else being equal, and result in greater profits for those bidders. . . . [Recipients] could therefore obtain large subsidies and generate private gains at public expense.")

2. Allowing satellite broadband providers to participate fully and directly in any reverse auctions would generate economies of scale, create incentives for satellite broadband providers to invest in new satellites, and otherwise benefit consumers in both "unserved" and "served" areas.

Allowing satellite broadband providers to compete for direct funding to serve any unserved area (regardless of the predicted cost of extending service to that area) would enable satellite broadband providers to achieve economies of scale that would facilitate the provision of broadband service to all such areas on an efficient and sustainable basis. These scale effects also would facilitate the ability of satellite broadband providers to provide a high-quality and cost-effective service even in those areas in which they do not receive support, and allow satellite broadband providers to lower prices *everywhere*.[45] The availability of satellite service in those areas would increase competition, and yield overall benefits in terms of price, consumer choice (*i.e.*, variety of service plan options), service quality (including improvements over time), implementation timetables, and other aspects of available service. As a result, satellite operators would have the funding and incentives to continue their expansion plans.

In contrast, limiting funding opportunities for satellite broadband providers to unserved areas with extremely high costs could impair the business case for satellite operators to invest in next-generation satellite broadband networks at all. As discussed above, there currently are no satellites under construction, or publicly announced, that will provide coverage of approximately 40% of the country—including large areas that are among the most-expensive to serve via terrestrial infrastructure. Depriving satellite providers of the ability to compete for CAF funding could leave them without the resources or ability to

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45 *Id.* ¶ 33 ("Because of the existence of large economies of scale, even in areas in which satellite broadband does not receive a subsidy, participation in the CAF would benefit consumers by generating a larger user base over which to spread fixed costs. This large user base, which lowers average costs, creates incentives for satellite broadband providers to invest in new spacecraft and support other service enhancements.").

attract investment to fund capacity expansion. As a result, extremely high-cost areas would be relegated to the continued receipt of inferior legacy satellite service that is not reasonably comparable to service available in other areas, as required by Section 254.[46]

These problems would be exacerbated if the Commission not only funded wireline competitors through the CAF but also funded wireless competitors in the same areas, whether through a separate mobility support mechanism, or through the CAF itself. Funding two competitors in the same service area—one wireline and one wireless—while excluding satellite from competing for that funding, not only would violate Commission policy and the Act, but also would create significant competitive distortions in the marketplace.

3. Allowing satellite broadband providers to partner with other providers and directly bid in any CAF reverse auctions as "prime" bidders would generate significant efficiencies that would lower the CAF funding burden.

Allowing a satellite broadband providers to serve as a "prime" bidder while partnering with other providers to offer a "complete package" of services (*e.g.*, voice and broadband) would lead to efficiency gains. Different providers have comparative advantages with respect to the provision of different services, and the logic of comparative advantage suggests that there will be public gains if these providers are allowed to partner with each other to enhance the value of the "complete package" for consumers.[47] Notably, satellite

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46 *Id.* ¶ 35 ("To the extent that the proposed CAF structure would deny direct participation to satellite broadband providers, it would make it less profitable to launch future satellites, hinder broadband expansion, and harm consumers.").

47 *Id.* ¶ 37 ("The logic of comparative advantage suggests that society is better off if each entity produces the good or goods for which it is best suited (i.e., has the lowest opportunity cost). When each firm produces the goods and services that it is best suited to produce, and then trade or partner with each other, output is enhanced to the benefit of consumers and society.").

broadband providers could pair their next-generation satellite broadband services with existing voice infrastructure to provide such a package at high-quality and low-cost.[48]

In contrast, compelling satellite operators to participate only indirectly also would allow "prime" funding recipients (*e.g.*, ILECs) to convert the potential public value of relatively low-cost satellite technologies into private gains (*i.e.*, profits). These "prime" funding recipients would have little incentive to lower their bids to reflect their ability to resell relatively low-cost satellite broadband capacity, and under the reverse auction mechanism, direct participants would not need to provide a cost-basis to justify their bids/support levels. Thus, these "prime" funding recipients could pocket the difference, and leave the public to shoulder the burden of subsidizing inefficient service and windfall profits.[49]

D. Allowing Satellite Broadband Providers To Participate Fully in the CAF Need Not Cause Undue Hardship to Incumbents.

Allowing satellite broadband providers to participate fully in the CAF need not cause undue hardship to the recipients of legacy high-cost support (*i.e.*, incumbent wireline providers). In fact, there are good reasons to believe that incumbents would continue to receive support in many areas under reverse auctions, even with the full participation of satellite broadband providers.

As an initial matter, satellite broadband providers initially will have coverage of geographic areas accounting for only about one-half of high-cost support currently distributed under legacy support mechanisms. (ViaSat-1's beam plan is attached as Exhibit C; Jupiter's beam plan is similar.) Further, satellite providers are unlikely to "win" support in

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48 *Id.* ¶ 38 ("Preventing a satellite broadband provider from engaging in such partnerships and then directly participating in the auction as a bidder is likely to lead to a misallocation of resources and lower quality of service for customers in unserved areas . . . .").

49 *Id.* ¶ 18.

all such areas. As noted above, Dr. Jackson's analysis shows that it would be less costly to close the investment gap with satellite broadband than other technologies in only about 47% of the areas that currently are "unserved."[50] Accordingly, incumbents likely will retain support in much of the country in the near to mid term.

Further, where satellite providers would have capacity and be able to "win" support from the CAF, they often would have strong incentives to incorporate existing terrestrial networks into their overall service offerings. In many markets it would be most efficient for a satellite broadband provider to make use of existing voice networks by either partnering with a terrestrial operator or reselling capacity on terrestrial networks. In either case, incumbent providers would enjoy a continuing revenue stream for some time. This would result in the implicit funding of separate voice and broadband networks, through market forces, and the reverse auction mechanism would ensure a more efficient outcome than having the Commission pick a single terrestrial broadband/voice network as the "winner" from an incomplete field of participants.

Finally, to the extent that the Commission is concerned about the short-term impact of the CAF on incumbents, it would not be unreasonable for the Commission to consider transition mechanisms to lessen that impact. While ViaSat believes that support should be transitioned away from incumbent providers where they do prevail in reverse auctions under the CAF, the creation of reasonable transition mechanisms certainly would be preferable to any approach that granted incumbent providers a perpetual preference through the CAF, excluded direct satellite participation, and thus rendered the CAF perpetually inefficient.[51]

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50 *See* Jackson Paper at 17.

51 The *NPRM* expresses the belief that "consumers currently served by terrestrial broadband or voice services should [not] lose access to their terrestrial service," but provides no support or justification for this belief, which runs contrary to the intended purpose of the CAF. *See NPRM* ¶ 428. Consistent with the principle of competitive

IV. VIASAT SUPPORTS THE USE OF REVERSE AUCTIONS TO ALLOCATE CAF SUPPORT, PROVIDED THEY ARE IMPLEMENTED IN A TRULY TECHNOLOGY-NEUTRAL MANNER

A. CAF Funding Should Be Awarded through a Reverse Auction Mechanism.

The *NPRM* proposes to distribute support for the CAF, both in Phase I and subsequent phases, through a competitive and transparent reverse auction mechanism. ViaSat agrees that competitive bidding could allow the Commission to take a market-based approach to determining how much universal service support, if any, is needed in any given area.[52] ViaSat also agrees that a *properly structured* competitive bidding system would help to ensure that limited funding flows to efficient carriers with low costs, thus reducing the amount of support needed to advance the Commission's universal service objectives.[53] For these reasons, ViaSat believes that reverse auctions should be used in all phases of the CAF.[54] By targeting support carefully, on the basis of census blocks or similar geographic units that do not replicate the service areas of any particular provider, the Commission could ensure that even limited funding makes a significant difference.

Reverse auctions will realize their true potential only if they are used as the exclusive means of distributing CAF support in all "unserved" areas, and all bidders compete on a level playing field. Thus, ViaSat strongly opposes any proposal that would give incumbent local exchange carriers rights of first refusal or similar preferences with respect to funding, or continue rate-of-return policies for certain geographic areas.[55] Any such

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neutrality and the objectives of the *NPRM*, where terrestrial services are not the most economical option, they simply should not be funded.

52 *See NPRM* ¶ 263.

53 *Id.*

54 The Commission could use Phase I to test particular implementations of the reverse auction mechanism in anticipation of subsequent phases of the CAF.

55 *See NPRM* ¶ 431.

approach would create inefficiencies, and would not be competitively or technologically neutral.[56]

B. The Reverse Auction Proposals in the *NPRM* Should Be Strengthened in Certain Respects.

While ViaSat generally supports the Commission's proposal to use reverse auctions to distribute limited CAF funding, the specific reverse auction proposals in the *NPRM* present significant issues that, if left unaddressed, would undermine the legality, efficiency, and effectiveness of the CAF.

1. The Commission should ensure that the public gets the most "bang for its buck" by allowing satellite operators to participate directly.

The *NPRM* proposes to exclude satellite broadband providers from direct participation in Phase I of the CAF, and suggests the possibility of extending such exclusion of subsequent phases of the CAF. As discussed above, this proposal appears to be motivated by the mistaken assumption that satellite broadband providers are capacity-constrained—an assumption that is factually incorrect and derived through a biased analytical framework. Accordingly, the *NPRM* provides no valid basis for excluding satellite providers from any reverse auctions under the CAF.

Instead, the Commission should permit satellite providers to participate freely in all phases of the CAF, as the Commission suggests in the context of long-term CAF support. This is the only approach that is competitively neutral and consistent with the requirements of the Act, as well as the Commission's prior determinations that *all* technologies, including satellite technologies, must remain eligible for universal service support as long as they meet basic statutory requirements. This also is the only approach that delivers the numerous benefits of allowing satellites providers to participate fully in the

56 If this approach is adopted and a cost model is used to estimate costs or set "reserve" levels, though, this model should reflect the costs of low-cost providers like satellite.

CAF—including a lower aggregate CAF funding burden and the more efficient distribution of limited CAF support.

In any event, satellite broadband providers, and not the Commission, are in the best position to determine how and where to deploy their "limited" capacity. Therefore, satellite broadband providers, like other broadband providers, should be permitted to act as rational market participants, and deploy their capital to serve the areas of greatest demand. Similarly, the Commission should recognize that satellite broadband providers are in the best position to manage their systems to ensure that their capacity is sufficient to sustain service to subscribers in a given area. That being said, the Commission can and should incentivize satellite broadband (and other) providers to realistically assess their capabilities, and to meet their build-out obligations, by requiring them to post a performance bond as a condition of receiving CAF support.

2. Any "one to a market" approach must be truly competitively and technologically neutral.

The *NPRM* proposes to use reverse auctions to select one entity (or partnership) in each geographic area to receive support from the CAF, during both Phase I and subsequent phases.[57] ViaSat believes that market forces are already driving the build-out of broadband infrastructure, and that a consumer should be allowed to choose the service provider that presents the best combination of performance and price for that consumer. To the extent that the Commission decides to fund only one broadband service provider per area, in order to conserve limited funding and streamline the administration of the CAF, it is critical that any such "one to a market" restriction be implemented in a competitively and technologically neutral manner. (Critically, any mechanism that would provide continuing support to legacy wireline providers for an extended period would violate this standard.[58])

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[57] *See NPRM* ¶¶ 281, 403.

[58] *See id.* ¶ 281.

ViaSat supports the *NPRM*'s proposal to allow bidding by joint ventures, partnerships, and similar consortia, and to allow funding recipients to partner with other service providers to offer a "complete package" of services—regardless of whether the winning bidder is a "voice" or "broadband" provider.[59] This approach would permit multiple service providers to join together to provide a cost-efficient package of services to consumers—consistent with the economic concept of comparative advantage, and the notion that higher levels of efficiency can be obtained through specialization. Some providers can deliver low-cost voice service efficiently, but cannot do the same with broadband service, while other carriers (including satellite broadband operators) are optimized to provide high-speed, high-quality broadband service, even in traditionally high-cost areas. By partnering with each other, these providers could improve their collective efficiency and reduce any subsidy required to otherwise have a single entity provide the entire suite of USF services. To avoid giving either provider undue leverage, any provider should be allowed to serve as the "lead" in such a bidding combination. Any proposal to relegate one technology to a "back seat" by precluding it from bidding directly[60] would unduly and unnecessarily distort the normal negotiations that could lead to the creation of the most efficient bidding consortium.

ViaSat suggests that the Commission redefine the "one to a market approach" to count the number of providers offering service in a given geographic area—as opposed to the number of providers receiving funding. In other words, any area with existing, unfunded and demonstrated service availability in virtually all households at the requisite speeds (*e.g.*, 4/1 Mbps) and an appropriate BHOL rate (*e.g.*, 160 kbps) from any type of provider

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[59] *See, e.g., id.* ¶¶ 418-420. *See also id.* ¶¶ 98, 132 (proposing to allow recipients to partner with a satellite voice provider to provide "voice telephony service" and "broadband service").

[60] *See id.* ¶ 427.

(wireline, wireless, satellite, etc.) should be ineligible for support (and should be deemed "served"). Similarly, any provider, regardless of whether it is an ETC, should be able to make a credible commitment to serve a given area within a specified period of time (*e.g.*, 3 years) *without* any CAF support by posting a performance bond, and thereby preclude the Commission from providing support to its competitors.

3. The Commission should clarify the circumstances in which an existing commitment to deploy capacity would render a provider ineligible to participate in a reverse auction.

The *NPRM* asserts that "[t]he goal of the first phase of the CAF is to increase broadband deployment in unserved rural and high-cost areas, not to fund existing facilities or deployment to which a carrier has already committed to federal or state regulators."[61] Thus, the *NPRM* asks whether the Commission should "explicitly limit funding in the first phase of the CAF to 'new,' or incremental, capacity or deployment to which the carrier has not already committed[.]"[62] The apparent intention of this proposal is to preclude parties that have made specific merger commitments, without any expectation of funding, to use CAF support to satisfy those commitments. However, such a limitation could be misconstrued to preclude the granting of support to entire classes of providers (*e.g.*, CMRS and satellite operators) that have "committed" to satisfy build-out obligations imposed in generally-applicable rules by accepting their licenses from the Commission.[63] This unintended result would undermine the objectives of the CAF. Accordingly, the Commission should clarify that any limitation on the eligibility of providers with existing "commitments" in place applies only to the extent that such commitments are provider-specific and imposed through transaction-specific conditions.

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61 *Id.* ¶ 308.

62 *Id.*

63 *See, e.g.*, 47 C.F.R. §§ 24.203, 25.164, and 27.14.

4. The CAF reverse auction mechanism should ensure that winning bidders provide *affordable* service to "unserved" households.

The *NPRM* seeks to make affordable broadband available to households that currently are "unserved."[64] However, the reverse auction mechanism proposed by the *NPRM* focuses on the characteristics of the broadband service that bidders would offer, and the subsidy that the provider would require to extend service, as opposed to the manner in which this service would be offered to consumers. In particular, the *NPRM* does not make clear that winning bidders would be required to provide *affordable* service to end users as a condition of receiving support.

ViaSat suggests that, prior to any reverse auction, the Commission specify an affordable price at which it expects the winning bidder to provide service to consumers for a defined period of time. The winning bidder would then be obligated to actually offer service at that price. In this fashion, the Commission could ensure that supported service is affordable, and facilitate its ability to perform apples-to-apples comparisons among bidders. This measure also would ensure that the provision of CAF support translates into lower rates for "unserved" households and an increased likelihood of service uptake, instead of merely lining the pockets of support recipients.

V. THE COMMISSION SHOULD ADOPT "BROADBAND" DEFINITIONS, STANDARDS, AND OBLIGATIONS THAT ARE COMPETITIVELY NEUTRAL

A. The Commission Should Adopt Neutral Definitions, Standards, and Obligations for "Broadband" and "Voice" Services.

The *NPRM* seeks comment on what definitions, standards, and obligations the Commission should adopt and impose under the CAF with respect to "broadband" and "voice" services.[65] As an initial matter, ViaSat is pleased that the *NPRM* proposes to characterize such services without reference to any particular technology, and shares the

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64 *See, e.g.*, *NPRM* ¶ 1.

Commission's expectation that funding recipients will choose a range of technologies—including both satellite and terrestrial technologies, wireline technologies, in varying combinations—to deliver service to end users.[66] This is consistent with ViaSat's role, first and foremost, as a communications solutions provider, as opposed to a mere satellite operator.

While ViaSat supports the Commission's desire to characterize "broadband" service without reference to any particular technology, ViaSat cautions that definitions and standards that do not *explicitly* favor one technology over another still can *effectively* do so, to the detriment of the objectives of the CAF and the continuing development and implementation of broadband and other advanced telecommunications services. ViaSat believes that the following measures will advance the Commission's efforts to adopt and impose definitions, standards, and obligations for "broadband" service that truly are competitively and technologically neutral.

1. The definitions, standards, and obligations adopted and imposed by the Commission should recognize the multidimensionality and evolving nature of "broadband" service.

As ViaSat has explained previously, any attempt to define "broadband" in terms of a few specific, fixed performance indicators raises potential concerns, because such an approach fails to account fully for the multidimensional nature of "broadband" or the fact that consumers' broadband needs vary and evolve over time.[67] As the *NPRM* itself

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65 *See generally id.* ¶¶ 95-154.

66 *Id.* ¶ 104.

67 *See* Mark D. Dankberg, Thomas E. Moore, and Girish Chandran, *Toward a National Broadband Plan: Ensuring a Meaningful Understanding of Broadband Capabilities and Facilitating Competitive Choices* (Aug. 31, 2009) (filed with the Commission on Aug. 31, 2009 in GN Docket No. 09-47). More specifically, such an approach may not reflect that: (i) different users place different values and weights on the various dimensions or capabilities of "broadband" services; (ii) different applications have varying performance requirements; and (iii) network operators establish varying

acknowledges, speed is an important dimension, but is only one dimension, of broadband performance.[68] "Broadband" is best viewed as a multidimensional concept, characterized by a variety of factors, including (but not limited to): peak and "provisioned" speed, service availability, security, burst capabilities, latency (delay) in transmitting and processing communications, jitter (variations in latency over time), mobility, and price. Because broadband solutions can vary across a large number of dimensions—and incorporate different combinations of features, performance, and price—at any given point in time a variety of broadband solutions are both technically and economically feasible. Some of these solutions may be quite similar to each other (*e.g.*, cable and DSL), while others may diverge significantly.

Each broadband technology has its own advantages with respect to certain important attributes of broadband service, and next-generation broadband satellites excel at providing speed—a critical factor in many broadband applications. These broadband satellite networks will support the 4/1 Mbps service envisioned by the *NPRM*, as well as higher speeds such as 8/2 Mbps and 12/3 Mbps (as well as on-demand symmetrical speeds for certain applications). Speed is recognized as one of the most critical factors in supporting applications such as telemedicine, distance learning and high definition video conferencing. In fact, the ability to support such higher and symmetrical speeds provides satellite a significant advantage over offer DSL and many terrestrial wireless technologies. Video streaming applications run smoother and better over satellite. High-definition video conferencing is possible in both directions over satellite (but not over DSL). ViaSat believes that its ability to offer high speeds, a quality experience, and a competitive price will make its satellite broadband service the first choice of many consumers.

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performance objectives and optimization goals in designing and implementing their networks and service offerings, and in pricing their services.

68 *NPRM* ¶ 105.

In contrast, terrestrial wireless services suffer from significant jitter (variations in latency), which noticeably affects the end-user experience (particularly with respect to video applications).[69] Nonetheless, ViaSat recognizes the benefits of wireless systems as, for some users, the benefit of being able to use a small, handheld, mobile wireless device is more important than having a smooth video streaming capability.[70]

For virtually all Internet applications, the difference in latency between satellite broadband and terrestrial wireless broadband is imperceptible. In fact, latency affects very few of the applications that consumers use and value most,[71] and we believe that for most consumers the limited impact of latency will be more than offset by other advantages that satellite service may be able to offer (for example, a higher-latency, low-jitter 8/2 Mbps or 12/3 Mbps satellite broadband service would likely be preferred by most consumers over a 4/1 Mbps lower-latency, long-loop DSL service or a 4/1 Mbps high-jitter wireless service). To the extent that the Commission wishes to avoid the latency impact on voice service of a "dual hop" (*i.e.*, service going from one satellite subscriber to a satellite, down to a network operations center, back up to the satellite and ultimately down to a second subscriber), that issue could be addressed through a variety of technological solutions, including (i) the use of geostationary orbit satellite mesh networking systems (*e.g.*, one

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69 *See, e .g.*, Mark Sullivan, *Cable Cutters: Can 4G Hotspots Replace Cable Broadband?* PCWORLD (Dec. 26, 2010), *available at http://www.pcworld.com/article/214620/cable_cutters_can_4g_hotspots_replace_cable_broadband.html* (noting that the inability of 4G technologies to "maintain a solid baseline speed for extended periods" can lead to "intermittent pixelation and other artifacts in . . . HD video"). *See also* Ken Florance, *Netflix Performance on Top ISP Networks*, The Netflix Tech Blog (Jan. 27, 2011), *available at* http://techblog.netflix.com/2011/01/netflix-performance-on-top-isp-networks.html (showing Netflix performance is weakest on Clearwire's wireless network).

70 ViaSat's Ka band networks will support the provision of mobile services to airplanes, watercraft, and motor vehicles. The satellite networks of certain MSS providers are optimized to provide service to small, handheld devices as well.

71 *See Cisco Visual Networking Index: Forecast and Methodology, 2009-2014*, at 10 (Jun. 2, 2010).

satellite hop systems), (ii) a hybrid satellite/terrestrial solution (where the satellite broadband provider supplements its capabilities with a terrestrial voice component), or (iii) a low-latency satellite solution (such as the use of a LEO or MEO satellite link). As noted above, allowing satellite providers to partner with other providers/technologies of their choosing is one important element of adopting a technology-neutral framework for the CAF that gives rise to proper market-based incentives for all participants.

It bears emphasis that focusing on latency characteristics when considering the value of satellite broadband service would make no more sense than focusing on jitter characteristics when considering the value of mobile wireless technology. In fact, as noted above, jitter is just another form of latency—one that varies over time and impacts video streaming in particular. And jitter impacts a far greater volume of traffic on the Internet than does the time delay associated with a geostationary satellite link, which is imperceptible for most broadband applications. The important point is not to whether satellite or wireless is better overall. The point is that end users balance the technical characteristics, price, and the other significant benefits of a given technology (such as speed and mobility), and they reach their own value determination.

Definitions and standards adopted by the Commission should be flexible enough to encompass these variations and value judgments, as well as the continuing evolution of consumer expectations with respect to "broadband" over time, in response to innovation and market dynamics. For example, if the Commission imposes service or coverage requirements in connection with the CAF, any such requirement should reflect the fact that a household is "served" or "covered" if it: (i) is within a provider's coverage area and (ii) could be served within a reasonable amount of time, subject only to routine measures necessary to "turn on" service. This would account for the fact that satellite providers typically must install a satellite antenna, modem, and related equipment prior to initiating service to a new subscriber (in the same way that DSL, fiber or cable modem service may require the installation of equipment at the end user's premises, or even a run of cable/fiber from the curb).

Critically, in the absence of government-mandated definitions of, or performance criteria for, "broadband," consumers will apply their own implicit or explicit performance "thresholds" in evaluating different broadband solutions, which are likely to vary from consumer to consumer. Through this process, the market should give rise to a variety of services that collectively may be viewed as "broadband"—and implicitly defined as such through an emergent, "bottom-up" process.

Any attempt by the Commission to impose a rigid, "top-down" definition of "broadband" could disrupt the natural evolution of such services, as well as continuing efforts to provide innovative broadband solutions to consumers. Importantly, the salience of various broadband characteristics is likely to vary over time, in unpredictable ways. It is likely that some of those dimensions will become less relevant, while other dimensions—including some that cannot be foreseen today—will become more relevant, as a result of changing technology and consumer preferences. Similarly, it is likely that the responsiveness of any given broadband technology to consumer needs and preferences will vary over time. For example:

- Consumers may demand new or different network capabilities in light of newly-introduced applications, or existing applications that become more desirable (*e.g.*, emergence of streaming video driving demand for high-speed, low-jitter service).

- Consumers may become more tolerant of certain network limitations due to their decreased salience for popular applications (*e.g.*, decreased salience of latency given increased use of texting and e-mail in lieu of voice communications).

- Consumers may take advantage of alternative services to substitute for some elements of an existing service—decreasing expectations with respect to related dimensions of broadband service while increasing expectations with respect to other such dimensions (*e.g.*, substituting low-cost telephone service for broadband-based VoIP, but demanding better media delivery capabilities).[72]

As we have seen already, the applications identified as important *by consumers who do not currently have broadband Internet access at home* are far different than the applications that many people "assume" are driving factors for the development of broadband policy. Studies show that downloading movies and music, and streaming audio files, currently are important drivers of consumers' broadband decisions—more so than in the past.[73] Indeed, five years ago, few would have predicted the development of services such as Hulu, or Netflix's delivery of movie rentals via the Internet, both of which are placing pressures on Internet access providers to evolve their systems.[74]

For this reason, the government should exercise caution before attempting to develop a long-term CAF structure based on assumptions about what aspects of broadband service are relevant to consumers today. Consumers and market forces—as opposed to the government—should determine which of these characteristics are most important. The Commission should ensure that any definitions, standards, and obligations adopted and imposed with respect to "broadband" and "voice" services provide sufficient flexibility, and refrain from taking any other action that would favor certain technologies over others, or explicitly or implicitly pick "winners" and "losers" in the marketplace. Certainly, the Commission should not adopt definitions, standards, or obligations that would hobble the ability of satellite or other broadband providers to support the applications that consumers

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72 Broadband providers can take advantage of these alternative technologies by creating "hybrid" offerings that improve their overall service offerings. For example, satellite broadband providers currently are developing mesh technologies that combine the benefits of satellite networks with those of distributed terrestrial networks.

73 *See* Consumer Electronics Association, *Broadband in America: Access, Use and Outlook*, at 8 (Jul. 2007), *available at* http://www.ce.org/PDF/CEA_Broadband_America.pdf.

74 *See* Amogh Dhamdhere and Constantine Dovrolis, *Can ISPs be Profitable Without Violating "Network Neutrality"?*, Paper delivered at NetEcon '08 (Aug. 22, 2008).

value most—*e.g.*, high-speed and low-jitter performance that facilitates video streaming and also supports browsing, texting e-mail (notably, satellite technologies excel in these areas). Rather, "broadband" definitions, standards, and obligations developed in connection with the CAF should focus on whether end-users are able to make use of the most-common broadband applications, as opposed to the specific technical aspects of any given service.

2. The definitions, standards, and obligations adopted by the Commission should be neutral with respect to manner in which a service offering packages multiple technologies or the capabilities provided by multiple providers.

The Commission's desire to establish definitions, standards, and obligations adopted that are technology neutral is admirable. True competitive and technological neutrality requires rules that encompass not only variations in a single technology, but also variations in the ways the different technologies and service providers/offerings are packaged. Thus, the Commission's rules should be flexible enough allow service providers to combine multiple technologies to offer "hybrid" solutions to consumers (*e.g.*, the use of "mesh" technologies, which will utilize additional satellite and/or terrestrial components to improve network performance). Those rules also should allow a single "broadband" service to package capabilities provided by multiple providers, through partnering or similar arrangements. Among other things, broadening the concept of competitive neutrality in this manner would facilitate efforts to provide "broadband" offerings that are most responsive to consumer needs, in the most efficient manner possible.

3. The definitions, standards, and obligations adopted by the Commission should not vary by geography.

While the *NPRM* seeks to define "broadband" without respect to any given *technology*, the *NPRM* does not endorse the notion that definitions, standards, and obligations adopted for and imposed on broadband providers should not vary by *geography*. This is an unfortunate omission, as true competitive and technological neutrality demands that the same standards and requirements apply across-the-board. Simply put, such neutrality cannot be maintained where a given class of technology or service provider is viewed as adequate in certain geographic areas but not others.

Yet, the *NPRM* proposes to limit the ability of satellite broadband providers to serve areas other than certain extremely high-cost areas. This suggests that the *NPRM* implicitly endorses one "broadband" standard for extremely high-cost" areas and another for lower-cost areas. Any such double-standard is inconsistent with Section 254(b)(3) of the Act, which requires that the Commission provide universal service support to allow "[c]onsumers in all regions of the Nation, including . . . consumers . . . in rural, insular, and high cost areas, . . . access to telecommunications and information services . . . that are reasonably comparable" to services provided in lower-cost areas.[75]

4. The Commission should not attempt to define the specific network components that are eligible for CAF support.

The *NPRM* does not appear to define explicitly which elements of a provider's network would be eligible for CAF support. ViaSat endorses this approach, as network architecture and infrastructure vary significantly by technology and provider. As such, any attempt to define what network components are eligible for support likely would lead to ambiguities, or favor one class of provider or technology over another. For example, existing legacy high-cost mechanisms provide support for "last mile" infrastructure, a concept with its roots in the traditional wireline context that has no obvious analogue in the satellite context.

As the Commission cannot anticipate how network technologies and infrastructure may develop in the future, a flexible approach in this area seems best. Consistent with Section 254(e) of the Act, the Commission should require only that support recipients use that support for the "provision, maintenance, and upgrading of facilities and

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[75] 47 U.S.C. § 254(b)(3).

services for which the support is intended."[76] Bidders should be able to seek support for whatever infrastructure they would use to support broadband services, and the Commission should clarify that they may do so (*e.g.*, that satellite providers may seek funding to support all elements of their network, including the satellite itself, gateway facilities, antennas and modems that provide the final network connection to the consumer, etc.). In contrast with current high-cost support mechanisms, the competitive nature of the reverse auction mechanism will limit the ability of providers to seek "excessive" support and would obviate the need for overly restrictive definitions of what network elements are covered.

5. The Commission should base any minimum "speed" standard on provisioned rates, not advertised speeds.

Although, as discussed above, ViaSat believes that any definition of or standard for "broadband" service should be flexible, ViaSat endorses the *NPRM*'s proposal to establish a minimum speed requirement for purposes of distributing CAF support. The proposed 4/1 Mbps seems acceptable, although ViaSat notes that a higher standard could be adopted, with limited financial impact on the CAF, given the benefits of satellite technologies. For example, ViaSat could easily provide an 8/2 Mbps or 12/3 Mbps service using CAF support, in many cases at costs that still would be lower than would be required for terrestrial providers to provide a 4/1 Mbps service. Such faster satellite broadband service, which could be upgraded over time, would likely be far more responsive to the long-term needs of consumers (and thus preferable to consumers) than a 4/1 Mbps DSL service that likely would not be easily upgraded.

Critically, the Commission should evaluate the "speed" of any given service in terms of "provisioned" rates (or the similar "BHOL" metric employed in OBI Technical Paper No. 1), as opposed to advertised speeds. The level of "provisioned" speed or bandwidth—*i.e.*, the minimum amount of total bandwidth allocated per subscriber across the

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76 *Id.* § 254(e)

provider's network—determines how congestion during peak traffic times affects the actual throughput levels enjoyed by the user, and the extent to which consumers will experience congestion, slow downloads, sluggish page load times and unacceptable performance.[77] Provisioned bandwidth also influences whether service providers actually are able to provide service at advertised network speeds. Thus, provisioned bandwidth, as opposed to simple "speed," is the best means of predicting the likely user experience, and facilitating apples-to-apples comparisons across technologies and providers. Moreover, it is critical that the Commission evaluate the bidder's ability to actually deliver this provisioning rate, and hold the bidder accountable for delivering the promised level of service over the funded network.

B. The Commission Should Condition Support on the Recipient's Satisfaction of Explicit Build-Out and Service Requirements.

Although ViaSat believes that the Commission should adopt standards for "broadband" service that are flexible and competitively neutral, ViaSat also believes that the Commission should adopt strong measures to ensure that CAF recipients actually provide valuable service to "unserved" households. In particular, the Commission should adopt clear coverage and service requirements and timetables to help ensure that the public gets value for its money, and provide the necessary incentives for CAF funding recipients to deliver *actual* service to "unserved" households in a manner consistent with representations made in those providers' winning bids.

More specifically, ViaSat supports the use of service and coverage milestones, backed by performance bonds. ViaSat notes that satellite operators already are subject to

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77 The level of bandwidth provisioned by a service provider can be derived empirically and represents a balance between: (i) subscriber traffic demands and the desire to receive advertised speeds 100% of the time; and (ii) the service provider's need to deliver an acceptable quality of service in the most economical fashion. The provisioning rate for any system can be readily calculated by dividing the total bandwidth available at the relevant choke point by the total number of subscribers that are assigned to share that bandwidth (i.e., the worst case situation where all subscribers contend for access simultaneously).

such milestones, and required to post performance bonds, as a condition of licensing.[78] These bonds help to deter the filing of "paper" satellite applications that waste Commission resources and delay the extension of service to the public. Similarly, any recipient of CAF support should be: (i) subject to milestone requirements (it would be appropriate to allow CAF recipients 3 years to implement their networks from auction award to deployment, although this is somewhat shorter than the 5-year period allowed under existing rules for satellite providers); and (ii) required to post a performance bond as a condition of receiving support, which would provide them with proper incentives to perform, and protect the CAF in case they fail to perform (as suggested by the *NPRM*).[79]

The Commission should enforce these requirements vigorously, and should not grant waivers except in extreme circumstances. Doing so would undermine the integrity of the bidding process, and encourage bidders to make unrealistic bids. Instead of seeking waivers after the fact, entities that cannot meet the milestone schedule either should not bid, or should partner with other providers/operators that can help to satisfy that schedule (*e.g.*, satellite providers). Again, the Commission's strict standard for granting waivers in the satellite milestone context offers useful precedent. Parties qualifying to receive support also should be liable for damages, and compelled to repay any support already received, in the event that they are unable to provide broadband service pursuant to the requirements of the CAF.[80]

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[78] *See* 47 C.F.R. § 25.

[79] *NPRM* ¶ 366.

[80] *See id.* ¶ 365.

VI. THE COMMISSION SHOULD STREAMLINE THE ETC DESIGNATION PROCESS TO FACILITATE THE TIMELY INTRODUCTION OF COMPETITIVE BROADBAND SERVICES IN "UNSERVED" AREAS

A. The Commission Can and Should Establish a Process To Designate "Nationwide" Providers as ETCs at the Federal Level.

The *NPRM* properly acknowledges concerns that "the ETC designation process imposes burdens on carriers that are interested in providing supported services in multiple states."[81] ViaSat echoes these concerns, which would be exacerbated if the current framework for ETC designation simply were extended to the broadband context through the CAF. Doing so would undermine significantly the ability of "nationwide" providers to advance objectives of the *NPRM* and extend broadband service to "unserved" areas quickly, and at low cost.

Under that framework, "nationwide" broadband providers would be forced to seek ETC designation in every state in which they plan to provide service. Because the ETC designation process is time-consuming, this would delay significantly the ability of these providers to extend broadband service to "unserved" areas quickly, and at low cost. Notably, state ETC designation proceedings can be highly politicized, and subject to the undue influence of incumbent providers. Further, states naturally lack expertise with newer technologies that have been introduced on a "nationwide" (as opposed to intrastate) basis, such as satellite technologies.

At the same time, "nationwide" providers would be unduly constrained by the need to satisfy the requirements and comply with the regulations of up to 50 (or more) different jurisdictions. These requirements could conflict with each other, as well as with the requirements and policies adopted by the Commission and elsewhere at the federal level—potentially in irreconcilable ways. The potential for such conflict is particularly acute where

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81 *Id.* ¶ 429.

providers use centralized infrastructure (*e.g.*, a satellite) to provide service directly to consumers in multiple jurisdictions, as well as to support interstate services.

Fortunately, the Commission has the requisite jurisdiction to avoid these issues by streamlining the ETC designation process for nationwide providers. If the Commission decides to support broadband services outside of the Section 214 framework, then the ETC framework in Section 214, and state designation requirements, would not apply at all. On the other hand, if the Commission determines that Section 214 is applicable, Section 214(e)(6) would give the Commission the requisite authority to designate satellite providers on a nationwide basis because satellite services are "not subject to the jurisdiction of a State commission."[82]

Notably, federal law and policy preempt state regulation where such regulation would "stand[] as an obstacle to the accomplishment and execution of the full objectives" of federal policy.[83] Any assertion of state jurisdiction over satellite broadband services necessarily would conflict with federal policy, and thus be subject to preemption.[84] In particular:

- Such services are "jurisdictionally mixed," without any practical way of separating the interstate and intrastate components of such service, or the components of such service internal to any particular state, such that any state regulation of such services unavoidably would reach interstate components subject to exclusive federal jurisdiction;[85]

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82 47 U.S.C. § 214(e)(6).

83 *La. Pub. Serv. Comm'n v. FCC*, 476 U.S. 355, 368-69 (1986). The Supreme Court has held that preemption may result not only from action taken by Congress but also from a federal agency action that is within the scope of the agency's congressionally delegated authority. *See Fidelity Federal Savings & Loan Ass'n v. De la Cuesta*, 458 U.S. 141 (1982); *Capital Cities Cable, Inc. v. Crisp*, 467 U.S. 691 (1984).

84 *Cf. Vonage Holdings Corporation Petition for Declaratory Ruling Concerning an Order of the Minnesota Public Utilities Commission*, Memorandum Opinion and Order, 19 FCC Rcd 22404 (2004) ("*Vonage Order*").

85 Satellite broadband services have "the inherent capability . . . to utilize multiple service features that access different websites or IP addresses during the same communication session and to perform different types of communications

- Such services rely on joint infrastructure (*e.g.*, a satellite) that provides service to end users in multiple jurisdictions across large geographic areas, and any state regulation of such infrastructure necessarily would impinge on the use of that infrastructure to serve other states or provide interstate service, or to advance federal broadband policy;

- Preempting state regulation of satellite broadband services is necessary to preserve and advance federal statutory objectives, including "Congress's clear preference for a national policy" of limited regulation of the Internet, and to forestall "multiple disparate attempts" to regulate such services, which would thwart their development.[86] (In contrast, allowing state regulation would invite the imposition of 50 or more sets of different regulations on satellite broadband providers, which in turn could risk eliminating or hampering these innovative advanced services that facilitate additional consumer choice, spur technological development and growth of broadband infrastructure, and promote continued development and use of the Internet."[87]

Critically, nothing in Section 214(e)(6) requires the Commission to wait for states to "waive" jurisdiction where it is clear that they would be preempted from asserting such jurisdiction.[88] Accordingly, the Commission can and should act to designate satellite providers as ETCs on a nationwide basis.[89]

B. Other Measures Also Would Streamline the ETC Designation Process, Particularly for "Nationwide" Broadband Providers.

Other measures also would streamline the ETC designation process, particularly for "nationwide" broadband providers. For example, the Commission can and

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simultaneously," which makes "jurisdictional determinations" with respect to such services "difficult, if not impossible." *Cf. Vonage Order* ¶¶ 24-25.

86 *Id.* ¶ 36. *See also* 47 U.S.C. § 230(b)(2) ("It is the policy of the United States . . . to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation.'"); 47 U.S.C. § 157 note (directing the FCC "to encourage the deployment" of broadband through measures that "'promote competition'" and remove "'barriers to infrastructure investment.'").

87 *Vonage Order* ¶ 37.

88 The Commission traditionally has sought an affirmative waiver from states with respect to terrestrial wireless services, over which states have exercised jurisdiction in the past, and which rely on infrastructure that can be segregated by jurisdiction. Satellite broadband services are easily distinguished in both respects.

89 In the alternative, the Commission could exercise its forbearance authority to establish a clock for, or bypass altogether, dilatory state ETC designation procedures.

should clarify that providers may proposed to use partnering or similar arrangements to satisfy ETC requirements and obligations, regardless of whether the applicant itself provides only broadband or voice service, or a "complete package" of services to the end user. Notably, some providers can deliver low-cost voice service efficiently, but cannot do the same with broadband service, while other carriers (including satellite broadband operators) are optimized to provide high-speed, high-quality broadband service, even in traditionally high-cost areas. By partnering with each other, these providers could improve their collective efficiency and reduce any subsidy required to otherwise have a single entity provide the entire suite of USF services.

The Commission also should modify the list of ETC obligations in its rules to ensure that it is flexible, neutral, and reflective of modern technology and network infrastructure. For example, the Commission should adopt a definition of "voice telephony service" that is flexible and competitively neutral, and does not turn on specific technical capabilities (as does the current definition of "basic local service"). In addition, the Commission should clarify that "voice" can be treated either as a separate service (and potentially provided through partnership arrangements with existing voice providers) or as an application of a broader "broadband" service (such that the funding recipient would not necessarily have to provide a separate "voice" service). These and similar measures would facilitate the timely broadband deployment of broadband services across the United States.

VII. CONCLUSION

While the *NPRM* advocates an approach to the CAF that is competitively-neutral, technology-agnostic, and market-based, the structure proposed in the *NPRM* falls short in all three respects. In particular, the proposed exclusion of low-cost satellite broadband providers from full and direct participation in all phases of the CAF would directly conflict with Commission precedent implementing Section 254 of the Act and establishing that *any* technology—including any satellite technology—should be eligible for universal service support. There is no justifiable basis for the *NPRM*'s discriminatory treatment of satellite providers and technologies. Satellite networks will *not* be capacity-constrained going forward, and limiting satellite participation in the CAF would increase the funding burden by ***as much as $21 billion dollars*** while denying the economies of scale necessary for satellite providers to expand their coverage and capacity in furtherance of the objectives of universal service.

The Commission should correct course to ensure that the CAF is structured in a legally-sound manner, and that the public can benefit from all that satellite broadband can deliver, by: (i) allowing satellite providers to participate fully and directly in all phases of the CAF, on a truly technology-neutral basis, and to receive support wherever they are the most cost-efficient solution; (ii) ensuring that "broadband" definitions, standards, and obligations established under the CAF are competitively neutral and flexible enough to account for variations among technologies and network architectures, and changes in consumer demand; (iii) adopting rules that are flexible enough to encompass all technologies, including "hybrid" solutions (pairing two different technologies), as well as partnering and similar arrangements between different service providers; (iv) making the identity of the direct bidder irrelevant, and allowing satellite broadband providers to participate in reverse auctions as "prime" bidders, just like any terrestrial broadband provider would be able to participate; and (v) streamlining the ability of "nationwide" providers—including satellite operators—to receive support quickly by establishing a *federal* process through which they could establish their "ETC" status. These types of corrections are the only way for the Commission to ensure that the CAF is competitively neutral, efficient, and consistent with the requirements of the Act and the public interest, convenience, and necessity.

Respectfully submitted,

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April 18, 2011

Exhibit A

Satellite Service Can Help to Effectively Close the Broadband Gap

Charles L. Jackson

April 18, 2011

"The optimal role could be in . . . ensuring that satellite can function as a ubiquitous bidder in a range of auctions."

OBI Technical Paper No. 1 at 40.

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Executive Summary

The Federal Communications Commission (FCC) has identified a broadband gap— seven million or more housing units that are home to at least fourteen million people that are unlikely to get broadband Internet access without some form of subsidy. The FCC established an Omnibus Broadband Initiative (OBI) to study this problem and to identify the most efficient way to close this gap. OBI Technical Paper No. 1 concluded that using satellites to serve only a small fraction of the currently unserved housing units would cut the cost of closing the broadband gap by more than half. However, OBI Technical Paper No. 1 did not propose any additional role for satellite in closing the broadband gap. The FCC appears to have relied on the analysis in OBI Technical Paper No. 1 in developing the National Broadband Plan and in developing the proposed rules for the Connect America Fund (CAF).

But, the analysis in OBI Technical Paper No. 1 of the potential role of satellites is flawed in at least four respects. OBI Technical Paper No. 1 made three serious errors when analyzing satellite broadband services.

First, it estimated the cost of satellite broadband service by extrapolating from market prices *today*. This extrapolation did not take into account either the current or future historical reduction of the “cost per bit” of satellite technology or the fact that the launch of new satellites will solve the current congestion on satellite broadband systems. This was quite different from the OBI analysis of the cost of terrestrial technologies such as wireless and ADSL where future expected costs of those technologies were considered, without regard to the state of network congestion today. In determining the cost of using terrestrial technologies to provide broadband access in currently unserved areas, OBI Technical Paper No. 1 developed a complex cost model that identified the costs of building and supporting new telecommunications plant to provide service. The need for subsidies was based on those future costs.

Second, it made no allowance for continuing technological progress in satellite communications—a field that has seen enormous progress in the past.

Third, OBI Technical Paper No. 1 failed to provide for any growth in satellite capacity beyond the launch of the next two broadband spacecraft, including that which necessarily would flow from the launch of additional spacecraft.

Fourth, a less distorting error was to calculate the cost of closing the gap with satellite broadband services as if every unserved housing unit would subscribe rather than adjusting for the expected rate of adoption by unserved housing units. A large portion of the projected cost of providing satellite service relates to actually connecting the end user.

These omissions caused the analysis in OBI Technical Paper No. 1 to overstate the cost and understate the capabilities of the satellite broadband alternative. The cost of providing satellite-based broadband access should be calculated and compared with the assumed revenue from broadband services. If technological progress continues into the future at its historical rates, then satellite capacity in 2015 should cost about half what it costs today.

Moreover, accounting for the type of capacity growth that has naturally occurred in the satellite industry significantly increases the number of housing units that satellite could serve in the near term—realistically—providing the capacity to serve about 6.6 million broadband subscribers by 2020, even with the FCC's predicted increase in bandwidth demands.

Taking all of these factors into account, this paper demonstrates that satellite is the least expensive way to serve at least 3 million additional housing units – a total of at least 47% of the broadband gap, for about $1.8 billion in subsidy. In contrast, serving these same housing units by terrestrial technologies would require support of $23 billion, based on the Commission's data.

Consequently, no decision should be based on OBI Technical Paper No. 1's conclusions regarding the suitability of a limited role for satellites. A sound analysis indicates that satellite service can provide an economically attractive alternative to close much of the broadband gap.

Introduction

The Commission has identified a broadband gap—the seven million housing units and fourteen million people to which it estimates broadband access cannot be extended without some form of economic support. The Commission has also created an ambitious National Broadband Plan designed to ensure that every American has access to broadband capability. The National Broadband Plan determined that closing the broadband gap using terrestrial technologies would cost $23.5 billion.[1] However, the National Broadband Plan also determined that using satellite services for only the 250,000 housing units that are most expensive to serve would drop the cost of closing the gap by more than half.[2]

This study examines the current and likely future performance and cost of satellite services in helping close the broadband gap. It confirms the analysis in the National Broadband Plan that satellite is by far the least expensive way to serve the 250,000 most-costly-to-serve housing units, but also demonstrates that satellite also is the least expensive way to serve at least 3 million additional housing units---a total of least 47%percent of the broadband gap, for about $1.8 billion in subsidy. In contrast, serving these same housing units by terrestrial technologies would require support of $23 billion, based on the Commission's data.[3] This report presents the results of analyzing the cost and performance of satellite broadband under a variety of assumptions. It first replicates the analysis that was used in developing the FCC's National Broadband Plan and that was relied on in the CAF NPRM. It then considers a variety of modifications to the assumptions used by the FCC in its analysis and shows how varying those assumptions results in projections of increased ability of satellite broadband systems to help close the broadband gap. The differences in assumptions are clearly identified, and the rationale for each difference is explained. The analysis is structured so that readers can apply their own judgments to the appropriateness of the various assumptions and see the implications of their judgments regarding the role of satellite.

This report begins with some background. It first reviews the various estimates of satellite capacity that FCC staff recently developed and employed in its policy analysis. Next, it looks at satellite technology—how it has developed over time and the nature of expected advances in the capacity of satellite systems providing two-way services to residences. It then discusses the process of funding, procuring, launching, and putting into orbit a new satellite. Finally, the report turns to the capacity analysis described above.

Satellite Capabilities Envisioned by the FCC

Over the last year, the FCC has expressed its view that, although satellites have an essential role in the National Broadband Plan—use of satellites cuts the cost of closing the broadband gap by more than half—satellites should not be expected to otherwise be counted on to play a significant

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[1] Notice of Proposed Rulemaking In the Matter of Connect America Fund, WC-Docket 10-90, Federal Communications Commission, Feb. 9, 2011, (herein after CAF NPRM), at footnote 597.

[2] *CAF NPRM,* at para. 424.

[3] *National Broadband Plan,* at p. 138. Throughout this report, as in the OBI analysis, subsidies are generally referred to in net present value terms with costs and revenues being discounted at 11.25% annually.

role in closing the broadband gap and satellite broadband providers should be ineligible to participate directly in at least Phase I of the Connect America Fund.

These views are set forth in three different documents—Technical Paper No. 1 of the Omnibus Broadband Initiative, the National Broadband Plan, and the CAF NPRM. These three documents are consistent in their treatment of the role of satellites, and all appear to be derived from the same analysis, which is reported in the most detail in OBI Technical Paper No. 1.

The key tool that the FCC seeks to employ in closing the broadband gap is to subsidize firms to provide broadband Internet access in areas where it would be uneconomic to otherwise provide such service. The CAF NPRM proposes that a reverse auction be held to determine which firm would be granted the right to provide subsidized broadband Internet access in a service area. Under Phase I, wireless and wireline companies would be permitted to bid for subsidies and to subcontract with satellite firms; satellite firms, even if they were willing to subcontract with wireless and wireline firms, would be ineligible to bid. Winners of such reverse auctions would be required to build out systems to cover their service areas in three years, and they would have an obligation to continue serving for some as yet undefined time afterwards.

Current and Future Satellite Technology

In the United States, the first commercial communications satellite went into service in 1974. That first satellite, Westar 1, had 12 transponders, and the earth stations used with it had antennas 15 meters in diameter. It is hard to calculate a proper comparison between that technology and modern satellites that use much smaller antennas. But, assuming that each transponder could transmit at 12 megabits per second, Westar 1 had a total capacity of 144 megabits per second.[4] Current state-of-the-art satellites, designed for residential Internet access, have a capacity of 130 gigabits per second.[5] This is an increase by a factor of about one thousand.[6] This corresponds to an improvement of 20% per year—not quite matching Moore's Law, but an enormous rate of progress.[7]

This improvement came from many different innovations in satellite and communications—not least those made possible by the progress in semiconductors described by Moore's Law. These innovations included the use of dual polarization (doubling capacities), higher frequencies (facilitating the use of smaller antennas), much larger satellite antennas (permitting the use of spot beams and more intensive frequency reuse), larger spacecraft (supporting the use of higher powers and permitting the use of larger antennas), improved modulation and signal design (made possible by Moore's Law), and improved system design. This improvement also came from access to additional radiofrequency spectrum.

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4 This data rate could not be achieved if one used a typical home satellite antenna about 0.7 meters in diameter with about 0.2% of the area of a 15 meter dish

5 OBI Technical Paper No. 1 at p. 90.

6 The more exact number for the improvement factor is 903.

7 If we had assumed that Westar 1 supported a higher data rate, say 500 megabits per second or one bit-per-second per Hertz (ignoring issues of transponder bandwidth and the comparison with small antennas), that would imply that the rate of growth was a still respectable 16% per year.

This progress was relatively even over time—it did not all happen one day due to a single brilliant insight. Table 1 compares some historical milestones in satellite development with the capacity that would have occurred following a simple 20% per year improvement rate.

Table 1. Satellite Capacity—Actual versus Predicted

Date	**U.S. Capacity of a Single Satellite (Mbps)**	**Predicted Capacity (assuming 20%/year improvement rate)**	**Comment**
1974	144	144	Westar 1
1982	288	619	Westar4 (24 Transponders)
1993	1,000	4,601	Ku-band satellites, 1 Gbps
1998	10,000	11,448	First-generation Ka-band satellite with spot beams, 10 Gbps
2011	130,000	122,481	ViaSat-1, Ka-band with many spot beams, 130 Gbps

There is no reason to think that progress in satellite technology has yet stalled. A wide variety of things are understood today that offer the promise of improved capacity—such as smaller spot beams, higher power, more complex signal processing, improved protocols, and use of additional radiofrequency spectrum. Consequently, any analysis of the utility of satellites in meeting the broadband gap should assume that the progress in satellite technology will continue in the future as it has done in the past. Not doing so would be like assuming that personal computing devices and smartphones in 2020 would be no better than they are today.[8]

The state-of-the-art in satellite broadband is exemplified by ViaSat-1 (due to be launched this summer) and the similar KA-SAT (launched last December and currently in geostationary orbit).[9] These satellites operate in the Ka-band (around 20/30 GHz—more than 10 times higher in the spectrum than the PCS and cellular bands) and use many spot beams (82 spot beams on KA-SAT, 80 on ViaSat) to deliver far more capacity per second than any of the hundreds of

8 At some point, the capacity of the orbital arc comes into play. The need for angular separation between satellites along the orbital arc implies a limit of perhaps 30 or 40 satellites serving the United States in any single satellite band. Even so, only about 10 of such locations are being or soon will be used in the Ka-band. Moreover, other parts of the Ka-band remain unmined, the "reverse DBS" band at 18 GHz remains largely unused, and the 40/50 GHz range remains an untapped resource.

9 *Eutelsat's KA-SAT Satellite Successfully on Station at 9° East and Undergoing in-Orbit Tests,* Eutelsat Press Release, 13 January 2011. Available at http://www.eutelsat.com/news/compress/en/2011/pdf/PR%200211%20KA%20SAT%20leop.pdf.

other spacecraft that have been launched to date (70 Gbps on KA-SAT, 130 Gbps on ViaSat).[10] Hughes plans to launch its Jupiter satellite next year, which it estimates will have more than 100 Gbps of capacity.[11]

The cost of communications satellites is dominated by the costs of the satellite bus and payload (the communications capabilities, the station-keeping and power-generating functions of the bus) and of its launch. Later-generation satellites cost about the same as earlier-generation satellites—but they do much, much more. Thus, progress in satellite performance has led to enormous decreases in the cost per unit of capacity in orbit (i.e., $/Mbps) and will continue to do so.

It is generally accepted that, under normal conditions, it takes about three years from the decision to build a satellite to the satellite becoming operational.[12]

The FCC's Analysis of Satellite Costs and Capacity

OBI Technical Paper No. 1 describes the model that the FCC developed to predict the cost of closing the broadband gap using a variety of technologies. It does not directly incorporate satellite technology into that model. Rather the authors conducted a separate analysis of satellites. That satellite analysis was based on a few basic assumptions:

- Satellite performance was that of the current (2010) state-of-the-art;
- Data usage would increase over time;
- User fees could be determined by considering current satellite service prices; and
- Satellite capacity would be limited to that already under construction.

Under these assumptions, OBI Technical Paper No. 1 concludes the following:

- A single satellite could serve about 440,000 housing units in 2015;
- User fees would be in the range of $70 to $120 per month; and
- Capital investment per user for the satellite service would be $700, $1,400, or $3,050, depending on assumed usage (low, medium, high).[13]

FCC staff calculated that a subsidy buy-down of satellite service—the payment necessary to close the gap between the user fees that it projected satellite firms would charge and the acceptably affordable level of $35 per month—would range between $35 and $85 per month.

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[10] ViaSat actually has 92 beams and a capacity of over 140 Gbps but some of the beams and capacity are owned by a third party and cover Canada.

[11] See http://defense.hughes.com/solutions-and-services/transformational-satcom-systems/jupiter.

[12] See OBI Technical Paper No. 1 at p. 92. Note also that the description of its Jupiter satellite by Hughes stated that development was begun in 2009 and that launch is scheduled for 2012.

[13] OBI Technical Paper No. 1 at Exhibit 4-AR.

This subsidy is assumed to continue for 20 years and is discounted to the present to yield a net present value (NPV) of the subsidy as $800 million for 250,000 housing units.

An Alternate Analysis

OBI Technical Paper No. 1 contains some unsound assumptions about unserved housing units, continuing technological developments in satellite communications, and the cost structure of the satellite industry. In this section, the implications of substituting more realistic assumptions are explored. Table 2 presents an analysis that parallels the analysis of OBI Technical Paper No. 1. This table was developed in order to provide a benchmark against which to compare the implications of varying some assumptions implicit in the FCC staff's model about extending broadband service to unserved housing units.

Specifically, like the OBI Technical Paper No. 1, Table 2 assumes that a modern satellite has 130 gigabits per second of capacity, that the capacity is split 60/40 between downlink and uplink, that 10% of the capacity is lost due to imperfect fill on some spot beams, and that user downlink demand follows either the medium- or high-usage scenario. The table shows that, under these assumptions, two ViaSat-1-like satellites could serve 870,000 housing units, or 435,000 each. OBI Technical Paper No. 1 calculated a capacity of 440,000 housing units per satellite.

Table 2. Reproduction of the FCC OBI Technical Paper 1 Analysis[14]

Scenario description: Medium-subscriber usage, no new satellites beyond ViaSat-1 and Jupiter, no technological progress. 35 Gbps of pre-existing capacity Per-sub usage growth rate = 27% Per-satellite investment = $400 million Includes capacity existing prior to 2011 Uplink/downlink traffic split = 60% downlink					
Variable	2011	2012	2013	2014	2015
Total downlink satellite capacity	99	177	177	177	177
Adjusted capacity for imperfect fill (90%)	89	159	159	159	159
Total satellite investment	400	800	800	800	800
Per-sub capacity required (kbps)	62	79	100	126	160
Housing units that can be served (millions)	1.45	2.02	1.59	1.26	1.00

The numbers shown in Table 2 match those in text and Exhibits on pages 90–91 of OBI Technical Paper No. 1. We can also calculate the cost of two state-of-the art satellites, one launching in 2011 and another in 2012, on a per subscriber basis. That is done in Table 3, which shows the capital investment per subscriber under the assumptions of Table 2 (but without factoring in preexisting satellite capacity) for two state-of-the-art satellites costing $400 million each.

[14] A more complete version of this table, showing all the intermediate calculations, is Attachment A to this report.

Table 3. Satellite Capital Expenditure Analysis

	2011	2012	2013	2014	2015
Total Satellite Capital Investment (millions)	$400	$800	$800	$800	$800
Satellite CapEX/subscriber (Medium Usage Scenario)	$351	$450	$570	$718	$912
Satellite CapEX/effective housing unit passed 83% take rate	$292	$374	$473	$596	$757
Satellite CapEX/effective housing unit passed 67% take rate	$235	$302	$382	$481	$611
Satellite CapEX/subscriber (High Usage Scenario)	$1,014	$1,009	$1,624	$2,051	$2,593
Satellite CapEX/effective housing unit passed 83% take rate	$842	$837	$1,348	$1,703	$2,152
Satellite CapEX/effective housing unit passed 67% take rate	$680	$676	$1,088	$1,374	$1,737

However, the calculations of per-user capital expenditure do not match the capital expenditure shown in OBI Technical Paper No. 1 at Exhibit 4-AR. That figure shows satellite capital expenditure per subscriber of $1,400 in 2015 in the medium-usage case and of $3,100 in the high-usage case.[15] Table 3 shows a capital expenditure of $912 in the medium-demand case and $2,593 in the high-demand case for 2015. The reason for the difference is that the capital expenditure shown in OBI Technical Paper No. 1 at Exhibit 4-AR may also include the costs of gateways and equipment at the user's location, and factor in the costs of preexisting satellite capacity. If we assume for purposes of this comparison that those investments total $500 per subscriber, then there is close match between the capital expenditure in Table 3 and that in OBI Technical Paper No. 1 ($1,412 vs. 1,400 and $3,093 vs. $3,050). Thus, this reproduction of the OBI Technical Paper No. 1 analysis yielded very similar results. Note that below, when we model those costs we use a significantly higher number—$715 in 2011 and declining by $5 per year thereafter.

15 We can check these values. The downlink capacity of a satellite under the OBI assumptions is 0.6*130 0.9 = 70.2 Gbps. Exhibit 4-AN shows medium usage of 160 kbps and high usage of 445 kbps in 2015. Now, 70.2 Gbps / 160 kbps = 487,500 users. And $400 / 487,500 = $912. Similarly, 70.2 Gbps / 455 kbps = 154,000 users, and $400 / 154,000 = $2592.

Projected Rural Broadband Subscribers

The first problem with the analysis in OBI Technical Paper No. 1 is that it does not take into account a less than a 100% adoption rate. Table 3 shows two other numbers for capital expenditure—measured against the effective number of housing units passed based on different adoption rates. Consider the 250,000 most expensive to serve housing units. Even with a generous subsidy, it is highly unlikely that the people living in every housing unit would subscribe to broadband Internet access. Some people are not interested in Internet services, others may be unwilling or unable to pay even the subsidized price, and still others may get adequate Internet access at work. Some housing units are occupied only part-time, and a part-time usage plan or portable access device may meet the needs at those housing units. A study prepared for the FCC's Omnibus Broadband Initiative estimated that today only 67% of households have broadband Internet access.[16]

One of the goals of the National Broadband Plan is to spur further adoption of broadband. An entire chapter is devoted to this challenge.[17] OBI Technical Paper No. 1 devotes several pages to analyzing the appropriate take-rate for broadband Internet access and develops a complex model that is used to predict the take-rate separately for each census block based on several demographic factors.[18] Exhibit 3-S to OBI Technical Paper No. 1 shows the forecast adoption rates for several different demographic groups, as well as an adoption rate labeled *overall*. The overall adoption rate reaches a maximum of about 83% after 10 years.[19] A more appropriate way to calculate the subsidies needed to buy down the cost of satellite service may be to incorporate the same take-rate analysis as was used for other technologies.

Table 3 shows how capital costs per effective home passed would decline if adoption were assumed to be only 83% or 67%. A similar reduction should be applied to the capital expenditures identified by the FCC staff. However, it does not appear to have been done. Thus, FCC staff estimates of the cost of closing the gap with satellite service for the last 250,000 unserved units appear to be inflated by a factor of 1.0/0.83, or 20%.[20]

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16 See the discussion below at footnote 19.

17 See Chapter 9 of the National Broadband Plan.

18 See OBI Technical Paper No. 1 at pp. 45–48.

19 That diagram displays much information and is hard to read. In particular, there are two lines drawn with the color used for the overall take-rate. We used the higher of the two lines to get the 83% number. If we had used the other line, the peak adoption would have been about 75%. It is possible that we have read the diagram too conservatively and that the relative economics of satellite are even more favorable than this analysis indicates. We also note that Exhibit 3-U does a sensitivity analysis by increasing the take rate by 15%. That implies that the average take rate used in the analysis in OBI Technical Paper No. 1 is no more than 85%. It is unclear to us whether the adoption rate is calculated for households are housing units. We have made the conservative assumption that it refers to housing units.

20 It might seem that, if the take rate is at most 83%, then the relevant inflation factor would be 17%. But, the proper calculation is to ask by what factor must one multiply the costs of serving 83% to obtain the cost of serving 100%? Well, 83%*1.2 = 100% — a 20% increase is required.

Technological Progress

A second, perhaps more important problem with the FCC analysis of the cost of satellite service is its implicit assumption that there will be no technological progress in satellite communications. More specifically, the analysis in OBI Technical Paper No. 1 assumes that the price of satellite capacity (per megabit per second) will stay constant for the next 20 years and discounts the required constant subsidy for 20 years at 11.25%.[21] The historical experience with satellite capacity has been quite different—at the historical rate of improvement of 20% per year, the cost of satellite Internet access would decline by a factor of 40 over 20 years.

If one assumes that the cost of satellite capacity were to decline at the historical rate of 20% per year, then the net present value of the required satellite capacity would fall by a factor of 2.45. Combining this factor with the adoption factor discussed above means that the cost of the satellite capacity required to serve the unserved in the fifth year should be decreased by a factor of 2.45/0.83, or 2.95. This is almost a factor of 3! The attractiveness of the satellite alternative in unserved areas must be considerably higher than the analysis in OBI Technical Paper No. 1 indicates if, as this analysis concludes, the satellite cost has been overestimated by a factor of 2.95.

Forecasting Usage

One important aspect of modeling the cost of broadband access is projecting the average user demand in the future. The cost of the satellite capacity consumed by a user grows directly proportionally to the busy hour usage. Similarly, some of the costs of 4G wireless and ADSL systems vary with usage so forecasting their costs also requires a forecast of usage. The method and forecasts of usage in OBI Technical Paper No. 1 appear reasonable and are adopted for use in this report. Using the same traffic levels as OBI used in their forecasts also ensures that our comparisons with their results is as apple-to-apple as possible.

But, some words of background and explanation may be helpful. OBI Technical Paper No. 1, in a section labeled network dimensioning, contains an extensive discussion of the problem of properly modeling user demand. They conclude that the appropriate average load in the busy hour (the busy-hour offered load [BHOL]) is 160 kbps in 2015.[22] That number, 160 kbps, was calculated by considering the usage of the median user in 2009 and assuming that usage grows 27% per year until 2015 when it reaches 160 kbps. That is an increase of a factor of 4 over the actual median average user load of 39 kbps in 2009.[23] And, OBI used that average usage of 160 kbps to calculate the costs of extending 4G wireless and ADSL systems.[24] Similarly, in

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[21] OBI Technical Paper No. 1 at p. 94.

[22] Specifically, at page 111 OBI Technical Paper No. 1 states "For our network dimensioning purposes, we shall use a BHOL of 160 kbps to represent usage in the future. Thus, this network will not only support the traffic of the typical user, but it will also support the traffic of the overwhelming majority of all user types, including the effect of demand growth over time."

[23] See OBI Technical Paper No. 1 at Exhibit 4-AN.

[24] At page 61, OBI Technical Paper No. 1 states "All of the technology comparisons in this chapter are based on network builds that can meet the target, with an effective busy hour load assumption of 160 kbps (see later section on Network Dimensioning). A fundamental tenet is that the networks have been modeled such

analyzing the subsidies needed to provide satellite broadband service to the 250,000 housing units that are most expensive to serve terrestrially, OBI Technical Paper No. 1 uses 160 kbps as the busy-hour average user load.[25]

Our model of satellite costs assumes that average user demand follows the same scenario as was used by OBI to estimate the costs of other technologies. Specifically, we assume that usage grows as shown in Exhibit 4-AN reaching 160 kbps in 2015. However, we also assume that usage continues to grow until it reaches 260 kbps in 2018. We do this because 260 kbps appears to be the actual average capacity of the ADSL system modeled in OBI Technical Paper No. 1. (Examining Exhibit 4-AJ one can calculate that the ADSL system modeled by OBI had a capacity of 260 kbps per user when fully loaded.[26])

This assumption of continued growth to 260 kbps makes the conclusions reached in this report about future satellite capacity more conservative than one based simply on 160 kbps. This conservative assumption makes for a closer comparison between satellite and ADSL by analyzing a satellite system that matches the actual capacity of the ADSL system.

Understanding the Cost of Satellite Service

One must also consider whether the specific level of the price of satellite service used in the FCC analysis was appropriate, even ignoring issues of take rate and technological improvement. The analysis of the cost of satellite broadband service in OBI Technical Paper No. 1 differs substantially from the analysis applied to other technologies. The analysis of ADSL or 4G wireless identifies the costs of providing building out ADSL and 4G wireless service, including a reasonable return on investment, and uses that cost to determine the gap (or subsidy) associated with that technology. The required subsidy is the difference between the estimated cost and the assumed revenue. In contrast, in OBI Technical Paper No. 1, future satellite service prices are not estimated by considering costs and the necessary returns to capital, but rather by considering today's prices for satellite service and adjusting them to reflect higher traffic levels. But, we know that broadband satellites today are capacity constrained.[27] In a capacity-constrained environment, one would not expect cost-based pricing. Rather, we expect congestion-based pricing, and economic theory teaches that congestion-based pricing would lead to consumer welfare gains.[28] Consequently, using today's capacity-constrained prices to predict future pricing is flawed—it is like using the price of corn during a drought to estimate the price of corn during a banner year for produce. The use of predicted satellite prices in OBI Technical Paper

that users will receive an equivalent level of service and performance whether they are serviced by the fixed wireless 4G access network or a 12 kft DSL architecture." See also p. 71 and p. 88 for specific statements regarding the use of 160 kbps to estimate the cost of 4G and ADSL networks.

25 See OBI Technical Paper No. 1 at Exhibit 4-AP and at pp. 91-94.

26 Exhibit 4-AJ shows that the modeled ADSL system can only support 26% of its users with 1 Mbps streaming service. This is an average downstream usage of 260 kbps. Because capacity in telecommunications systems often comes in discrete lumps, building an ADSL system to have an average capacity of 160 kbps results in building one with somewhat more capacity.

27 See OBI Technical Paper No. 1 at p. 90.

28 See, for example, http://ops.fhwa.dot.gov/publications/congestionpricing/index.htm.

No. 1 based on today's congestion means that the OBI analysis was not apples-to-apples with terrestrial technologies.

In OBI Technical Paper No. 1, the cost of ADSL service is calculated by considering capital expenditures, operating costs, and revenues. Operating costs and revenues are converted to net present values by discounting at 11.25%. This process is described in OBI Technical Paper No. 1 as ". . . we equivalently set the internal rate of return (IRR) of these incremental broadband buildouts to 11.25%."[29] The broadband gap associated with ADSL service is calculated by comparing the costs of providing ADSL service with the expected (subsidy-free) revenues.

The analysis in OBI Technical Paper No. 1 assumes that the appropriate subsidy-free price for Internet access alone such as is provided by satellite service is $35 per month.[30] A constant stream of monthly payments of $35 for 20 years discounted to the present at 11.25% annual rate (0.8924% per month) has a net present value of $3,457.[31] This is the subsidy-free cost of broadband Internet access. That is, a broadband Internet access alternative with net present value of costs of $3,457 is assumed to require no subsidy, but alternatives with any higher cost would require subsidy.

Analysis of Satellite Costs

Table 4 presents an alternate analysis of satellite costs and capacities. The analysis was done in the same fashion as that in Table 2, which reproduced the analysis of OBI Technical Paper No. 1. However, the following assumptions were changed:

- The performance of new satellites is assumed to improve at the long-term average rate of 20% per year; and
- The satellite broadband industry is assumed to launch a new satellite every year, starting in 2014.

These two assumptions are significant differences because they predict the capacity growth that has naturally occurred in the satellite industry[32]. They also significantly increase the number of housing units that satellite broadband could serve in the near term—realistically providing the capacity to serve about 6.6 million broadband subscribers (medium-demand scenario) by 2020, even with the FCC's predicted increase in bandwidth demands.

The changed assumptions in Table 4 are in bold and italics for emphasis.

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29 OBI Technical Paper No. 1 at p. 33.

30 OBI Technical Paper No. 1 at p. 93.

31 The annual discount factor of 1.1125 is here converted to a monthly discount factor of $1.1125^{1/12}$, or 1.008924. This results in the discount factor for a 12-month period being 1.008924^{12}, or 1.1125.

32 By way of analogy, since its inception in the mid-1990s, the satellite TV industry has launched over two dozen DBS satellites. *See* DIRECTV 2010 10-K at 7 (noting that DIRECTV "currently ha[s] a fleet of twelve geosynchronous satellites . . . ."); DISH Network 2010 10-K at F-18 ("We currently utilize 13 satellites in geostationary orbit . . . .").

Table 4. Satellite Capacity Assuming Technological Progress[33]

Scenario description: Medium-subscriber usage, ***one new satellite per year after 2014***, as well as ViaSat-1 and Jupiter, ***20% per year technological progress***. State-of-the-art in 2011 is 130 Gbps. Considering only the capacity of satellites launched in 2011 and later. Per-sub capacity growth rate = 27% Per-satellite investment = $400 million Does not factor in capacity existing prior to 2011(we lack the data to do the capital analysis) Uplink/downlink traffic split = 60% downlink					
Year	**2011**		**2015**		**2020**
Total downlink satellite capacity	78		453		1897
Adjusted capacity for imperfect fill (90%)	70		407		1707
Total satellite investment (millions)	$400		1,600		3,600
Per-user capacity need (kbps)	62		160		260
Housing units that can be served (millions)	1.14		2.55		6.57

We can also look at the satellite investment required per supportable housing unit and per housing unit actually served. Those numbers are shown in Table 5 below. Note that in 2011 in the medium-usage scenario, the per subscriber satellite capital investment is only $351.

33 A more complete version of this table, showing all the intermediate calculations, is Attachment B to this report.

Table 5. Satellite Capital Expenditure Analysis Assuming Technological Progress and Continued Satellite Deployment (Not Including Customer Equipment)

Capital Expenditure	2011	2015	2020
Total satellite capital investment (millions)	$400	$1,600	$3,600
Satellite CapEX/housing unit subscribing (medium-usage scenario)	$351	$629	$548
Satellite CapEX/effective housing units served, 83% take-rate	$292	$522	$455
Satellite CapEX/effective housing unit served, 67% take-rate	$235	$421	$367
Satellite CapEX/housing unit subscribing (high-usage scenario)	$1,014	$1,787	$1,548
Satellite CapEX/effective housing unit served, 83% take-rate	$842	$1,483	$1,285
Satellite CapEX/effective housing unit served, 67% take-rate	$680	$1,197	$1,037

Although the changes made to the assumptions are relatively small—the most important change being the assumption of continuing technological progress in the satellite industry—the resulting conclusions are markedly different. In particular, the satellite capital investment per subscriber in the medium-usage scenario in 2015 has fallen to $629, and the investment per effective home served (assuming an 83% take rate) has fallen to $522. If we use the $500 per-subscriber allowance for non-satellite capital costs from OBI Technical Paper No. 1,[34] then we get a total investment per subscriber of $1,129 for the medium-usage scenario in 2015. This is a small fraction of the present value of the income stream associated with a subscriber. OBI Technical Paper No. 1 assumes that a data-only subscriber will pay $36 per month.[35] At a discount rate of 11.25% annually for 20 years, this stream of payments has a net present value of $3,556. Subtracting the $1,129 initial capital costs from this leaves $2,427 as an allowance for operating expenses and other costs. The cost models in OBI Technical Paper No. 1 consistently show operating expenses as having a net present value of about the same magnitude as the initial capital investment.[36] Thus, under these assumptions, and before factoring in the cost of customer equipment, it appears quite reasonable to conclude that by 2015, satellite systems would need relatively little subsidy to serve a large fraction of the broadband gap in the medium-usage scenario. OBI Technical Paper No. 1 states that "Operating costs for a satellite broadband operator are typically lower than for a wired network provider."

The analysis of the satellite cost per subscriber is straightforward. However, the analysis of other capital costs and of operating expenses is more complex. As explained above, OBI

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34 At p. 92.

35 See OBI Technical Paper No. 1 at Exhibit 3-V. Note that OBI Technical Paper No. 1 also considers a data service price of $43 per month for wireless in some areas and used a $35 per month figure when estimating the cost of subsidizing satellite service.

36 See, for example, OBI Technical Paper No. 1 Exhibit I-A at p. 5.

Technical Paper No. 1 appears to be based on an assumption that other capital costs, mostly gateways and customer equipment, will total $500. ViaSat informs me that reasonable values to use for the upfront investment needed to put a customer in service total $715 in 2011 and are expected to decline at about $5 per year due to decreases in the cost of the electronics at the customer premises. ViaSat also informs me that a reasonable value for the monthly operating expense per user is $24.

We also added a calculation of the tax effects following the approach used in OBI Technical Paper No. 1 at Exhibit 4-AX.

We can combine all these numbers to generate an estimate of the subsidy required for satellite broadband in exactly the same manner as OBI Technical Paper No. 1 does for ADSL and 4G wireless. Doing so we get the results shown in Table 6. Because technology is changing and traffic is growing, the required subsidy varies depending upon which year one does the calculation. However, the required subsidies are relatively small. In the medium usage case, the maximum subsidy of $649 occurs in 2017.

It bears emphasis that these calculations are provided to demonstrate the cost-effectiveness of satellite broadband, when compared with terrestrial technologies on the same terms. Of course, the amount that an individual bidder in an auction would require may depend on a variety of factors not considered by OBI Technical Paper No. 1, such as less than 100% adoption in a given area, subscriber churn, and actual or potential competition from other providers. A full analysis of those factors is beyond the scope of this paper.

Table 6. The Apples-to-Apples Cost and Subsidy for Broadband Satellite (Medium Usage, Continued Satellite Deployment, 100% Adoption)

Quantity	2011	2015	2020
Satellite CapEx/subcriber (medium usage scenario)	$351	$629	$548
Other Upfront Investments	$715	$695	$670
Present Value of Operating Expense	$2,371	$2,371	$2,371
Present Value of All Investment and Costs (medium usage)	$3,437	$3,694	$3,589
Present Value of Revenue	$3,556	$3,556	$3,556
Taxes[37]	$267	$331	$305
Subsidy Required	$148	$469	$338

[37] Calculated as in OBI Technical Paper 1 Exhibit 4-AX.

Examining the Gap

Exhibit 3-H of OBI Technical Paper No. 1 and the essentially identical Exhibit 8-C of the National Broadband Plan show the cumulative distribution of the subsidies required to close the broadband gap versus the percentage of housing units served. Exhibit 3-H is reproduced below. The least expensive housing units require relatively little subsidy, the last 25 or 30% of housing units require substantial subsidies.

Examining Exhibit 3-H allows calculation of the distribution of the required subsidies by percentile. Attachment C describes how this was done, based on the data available to us at this point in time. The resulting distribution is not completely in line with Exhibit 3-H, but various checks show that it must be quite close to the distribution underlying Exhibit 3-H.

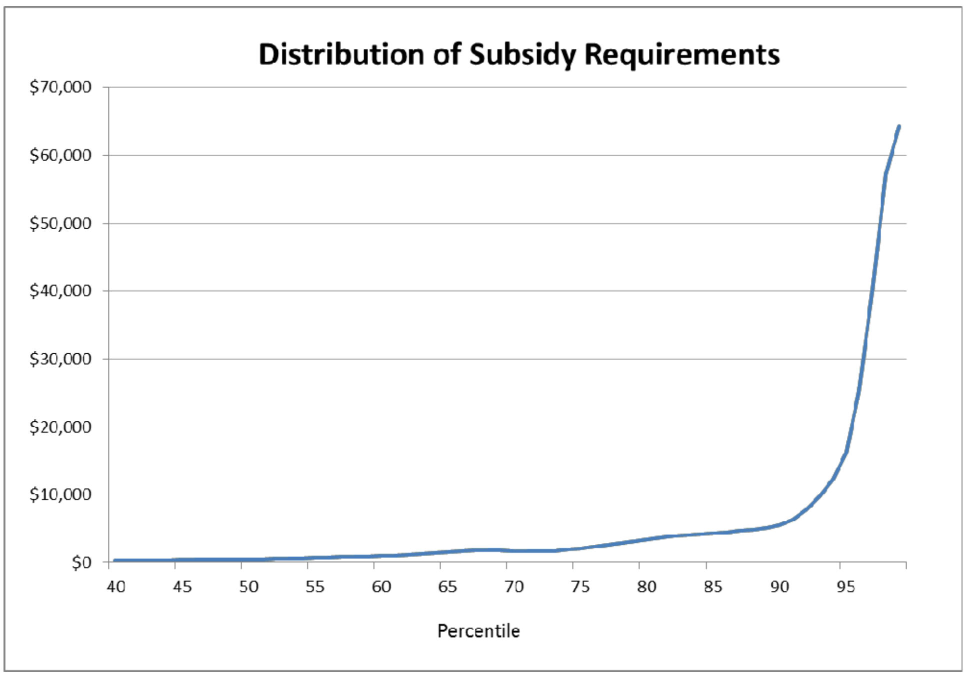

Figure 1. Distribution of Subsidies Needed to Close the Broadband Gap

Several interesting features can be seen from this figure. First, the subsidies required for the first 40 percent of housing units are quite low. Second, recall that OBI Technical Paper No. at page 94 calculated that the subsidy needed to use satellite to serve the 250,000 most expensive to serve housing units would require a total subsidy of $800 million. That works out to $3,200 per housing unit. If we adjusted for the fact that not all housing units will be subscribers then the actual cost to close that part of the gap would fall. Assuming only 83% of housing units subscribe, the actual cost required to close that part of the gap would be $664 million. Examining Figure 1 shows that about 20% of the housing units in the gap require a subsidy of more than $3,200. So, even using the flawed analysis of satellites in OBI Technical Paper No. 1 satellite is the most cost-effective technology for serving 20% of the gap or 1.4 million housing units! OBI Technical Paper No. 1 offered an alternate estimate, based on a satellite price of $120 per month, or $2 billion in present value to subsidize the last 250,000 housing units.[38] This works out to $8,000 per housing unit. About 8% of the housing units in the gap, or more than 500,000, require a subsidy larger than that. Thus, using its own data (and putting aside the analytical flaws identified above), one must question the conclusion in OBI Technical Paper No. 1 that satellite should be used only to serve the last 250,000 housing units.

Above, the necessary subsidies were calculated on the apples-to-apples basis and the highest subsidy under the medium-usage scenario was $649 in 2017 (Note, the column for 2017 was not shown in order to keep the table compact, but is shown in Attachment B). At that subsidy level, satellite is the most cost-effective technology for about 47% of the gap, or 3.3 million housing units. The cost to close that 47% of the gap would be ($649 per housing unit) times (3.3 million housing units) times (83% take rate) or $1.8 billion. In contrast, Exhibit 3-H of OBI Technical Paper No. 1 shows that closing the last 47% of the gap would cost about $23 billion—about 13 times more (note that at a take-rate of 83%, only 2.7 million subscribers need to be served.) Looking at the spreadsheet underlying Table 6 (and available in Attachment B), assuming the launch of one new broadband satellite per year starting in 2014 would provide the capacity needed to do this by 2016. If one considers the maximum subsidy required in the high-usage case, $2,453 in 2017 (again this number appears in Attachment B), it is still the case that satellite broadband is the most cost-effective technology for about 23% of the gap. The cost to close that 23% of the gap would be ($2,453 per housing unit) times (1.61 million housing units) times (83% take rate) or $3.2 billion. In contrast, Exhibit 3-H of OBI Technical Paper No. 1 shows that closing the last 23% of the gap would cost more than $20 billion—about six times more. As detailed in Attachment B, assuming the launch of one new broadband satellite per year starting in 2014 would provide the capacity needed (for 1.3 million subscribers, or 1.61 million times an 83% take rate) to do this by 2018. (Recall that this is not an apples-to-apples comparison as the high-capacity demand in 2019 is about three times the design maximum of ADSL systems considered in OBI Technical Paper No. 1.)

Implications of the Assumptions

Table 7 below summarizes the implications of varying only one of the assumptions in the OBI analysis. That is, if one redoes the analysis of satellites as was done in OBI Technical Paper No. 1 after changing a single assumption, the conclusions are changed as described in the right-hand column.

[38] Again, adjusting for 83% fill, the 2 billion falls to $1.66 billion.

Table 7. Consequences of Varying the Assumptions

Assumption	Implication for Satellite Competitiveness
Analyze the required subsidy for satellites using the same, cost-based approach that OBI uses in its analysis of other technologies.	The required subsidy shrinks enormously. Satellite becomes the technology requiring the least subsidy in a substantial fraction of the broadband gap.
Factor in the expected effects of technological progress in satellite communications.	Satellite becomes far more cost-effective in future years than would otherwise be predicted.
Calculate required subsidies by assuming, as OBI does in its analysis of other technologies, that only a portion of housing units, one growing over time, will subscribe to broadband access.	Some of the satellite subsidy requirements calculated in OBI Technical Paper No. 1, such as the subsidy needed for the last 250,000 housing units, shrink significantly (i.e., service to fewer housing units must be subsidized).

Conclusions

OBI Technical Paper No. 1 concludes that using satellites to serve only a small fraction of the currently unserved housing units could cut the cost of closing the broadband gap by more than half. The analysis in OBI Technical Paper No. 1 substantially underestimates the role of satellites could play in closing the broadband gap, because it suffers from at least four flaws.

First, it estimated the cost of satellite service by extrapolating from market prices today. This extrapolation took into account neither current or future satellite technology nor the fact that new satellites will solve the current congestion on satellite broadband systems. This was quite different from the OBI analysis of the cost of other technologies such as wireless and ADSL where future expected costs of those technologies were considered without regard to the state of network congestion today. In determining the cost of using those technologies to provide broadband access in currently unserved areas, OBI developed a complex cost model that identified the costs of building and supporting new telecommunications plant to provide service. The need for subsidies was based on those future costs.

Second, it made no allowance for continuing technological progress in satellite communications—a field that has seen enormous progress in the past.

Third, OBI failed to provide for any growth in satellite capacity beyond the launch of the next two broadband spacecraft, including that which necessarily would flow from the launch of additional spacecraft.

Fourth, a less distorting error was to calculate the subsidies required for satellite broadband services as if every unserved housing unit would subscribe rather than adjusting for the expected rate of adoption by unserved housing units.

Each of these errors caused the analysis in OBI Technical Paper No. 1 to overstate, sometimes dramatically, the cost and understate the capabilities of the satellite alternative. The cost of providing satellite-based broadband should be calculated and compared with the assumed revenue from service to end users. If technical progress continues into the future at its historical rates, then satellite capacity should cost half what it costs today.

OBI Technical Paper No. 1 also indicates that the time required to build a satellite makes the use of satellites problematic, claiming, "Timing may be an issue if satellite broadband were deployed as the only means of reaching the unserved, as a next-generation satellite takes approximately three years to build."[39] The CAF NPRM proposes that winners of reverse auctions have three years to deploy their systems. If a satellite service provider has a satellite scheduled for deployment or has taken the initial steps towards procuring a new satellite before the reverse auction is held at some undetermined point in the future, or otherwise has capacity available, then it should be able to meet such a deadline.

About the Author

Dr. Charles L. Jackson is an electrical engineer who has worked extensively in communications and wireless. He has been both a digital designer and a system programmer. He works as a consultant and as an adjunct professor at George Washington University, where he has taught graduate courses on computer security, networking and the Internet, mobile communications, and wireless networks. Dr. Jackson consults on technology issues—primarily wireless and telecommunications. Dr. Jackson served three terms on the FCC's Technological Advisory Council. He previously worked at both the FCC and the House Commerce Committee. He holds two U.S. patents. Dr. Jackson received his PhD from MIT.

[39] OBI Technical Paper No. 1 at p. 92.

Attachment A

Reproduce FCC OBI Technical Paper 1 Analysis in Exhibit 4-AX scenario use FCC parameters

Per Sub Capacity Growth Rate (note, growth is capped in 2017)	27%		Fraction of satellite capcity lost to incomplete fill	10%
Sat Cap Growth Rate	0%		Medium capacity usage in 2011	62 kbps
Per Satellite Investment (millions)	$400		High capacity usage in 2011	178 kbps
State-of-the Art Satellite Capacity 2011	130	Gbps	Effective Tax Rate	20%
Capacity Existing Prior to 2011	35	Gbps		
Capacity Used on Downlink	60%			

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Expected Capacity of Additional Satellite - Downstream (Gbps)	78	78	78	78	78	78	78	78	78	78
ViaSat Satellite Capacity										
New Satellites Launched	1	-	-							
Added Capacity in Orbit (Gbps)	78	-	-	-	-	-	-	-	-	-
Cummulative Capacity in Orbit (Gbps)	78	78	78	78	78	78	78	78	78	78
Other Satellite Industry Capacity										
New Satellites Launched	-	1	-							
Added Capacity in Orbit (Gbps)	-	78	-	-	-	-	-	-	-	-
Cummulative Capacity in Orbit (Gbps)	-	78	78	78	78	78	78	78	78	78
Satellites In Orbit	1	2	2	2	2	2	2	2	2	2
Total Downlink Satellite Capacity	99	177	177	177	177	177	177	177	177	177
Adjust Total for Imperfect Fill (90%)	89	159	159	159	159	159	159	159	159	159
Capacity Needed (OBI TP 1 Medium Usage Scenario)										
Per Sub Capacity Required (kbps)	62	79	100	126	160	203	258	328	416	529
Housing units that can be served (Millions)	1.445	2.016	1.593	1.264	0.996	0.784	0.617	0.486	0.383	0.301
Capacity Needed (OBI TP 1 High Usage Scenario)										
Per Sub Capacity Required (kbps)	178	225	285	360	455	578	734	932	1,184	1,503
Housing units that can be served (Millions)	0.501	0.708	0.559	0.443	0.350	0.276	0.217	0.171	0.135	0.106
Satellite Capital Expenditure Analysis										
Total Satellite Capital Investment (millions)	$400	$800	$800	$800	$800	$800	$800	$800	$800	$800
Satellite CapEX/subscriber (Medium Usage Scenario)	$277	$397	$502	$633	$804	$1,020	$1,296	$1,646	$2,090	$2,655
Satellite CapEX/effective housing unit passed 83% take rate	$230	$329	$417	$525	$667	$847	$1,076	$1,366	$1,735	$2,203
Satellite CapEX/effective housing unit passed 67% take rate	$185	$266	$336	$424	$538	$684	$868	$1,103	$1,401	$1,779
Satellite CapEX/subscriber (High Usage Scenario)	$799	$1,130	$1,431	$1,808	$2,285	$2,902	$3,685	$4,681	$5,944	$7,549
Satellite CapEX/effective housing unit passed 83% take rate	$663	$938	$1,188	$1,501	$1,897	$2,409	$3,059	$3,885	$4,934	$6,266
Satellite CapEX/effective housing unit passed 67% take rate	$535	$757	$959	$1,211	$1,531	$1,944	$2,469	$3,136	$3,983	$5,058

The independent variables in this spreadsheet are those in the lightly shaded region and the 83% and 67% take rates. All other values are calculated from those values.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Satellite CapEx/subcriber (medium usage scenario)	$277	$397	$502	$633	$804	$1,020	$1,296	$1,646	$2,090	$2,655
Other Upfront Investments	$715	$710	$705	$700	$695	$690	$685	$680	$675	$670
Present Value Factor	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
Operating Expense	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Present Value of Operating Expense	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371
Present Value of All Investment and Costs(medium usage)	$3,362	$3,477	$3,578	$3,703	$3,869	$4,081	$4,352	$4,696	$5,136	$5,695
Monthly Average Revenue per User	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36
Present Value of Revenue	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556
Taxes	$248	$277	$302	$333	$375	$428	$495	$581	$691	$831
Subsidy Required	$55	$198	$324	$481	$688	$953	$1,291	$1,722	$2,271	$2,971
Satellite CapEx/subcriber (high usage scenario)	$799	$1,130	$1,431	$1,808	$2,285	$2,902	$3,685	$4,681	$5,944	$7,549
Other Upfront Investments	$715	$710	$705	$700	$695	$690	$685	$680	$675	$670
Present Value Factor	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
Operating Expense	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Present Value of Operating Expense	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371
Present Value of All Investment and Costs(medium usage)	$3,885	$4,211	$4,507	$4,878	$5,351	$5,962	$6,741	$7,731	$8,990	$10,590
Monthly Average Revenue per User	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36
Present Value of Revenue	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556
Taxes	$379	$460	$534	$627	$745	$898	$1,093	$1,340	$1,655	$2,055
Subsidy Required	$707	$1,115	$1,485	$1,950	$2,540	$3,305	$4,278	$5,515	$7,089	$9,089

Attachment B

Reproduce FCC OBI Technical Paper 1 Analysis in Exhibit 4-AX scenario Description: Medium and high subscriber usage, technical progress, one new satellite per year from 2014 on, no consideration of capacity existing prior to 2011.

Per Sub Capacity Growth Rate (note, growth is capped in 2017)	27%		Fraction of satellite capcity lost to incomplete fil	10%	
Sat Cap Growth Rate	20%		Medium capacity usage in 2011	62	kbps
Per Satellite Investment (millions)	$400		High capacity usage in 2011	178	kbps
State-of-the Art Satellite Capacity 2011	130	Gbps	Effective Tax Rate	20%	
Capacity Existing Prior to 2011	-	Gbps	(omitted because we lack the data to do the capital analysis)		
Capacity Used on Downlink	60%				

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Expected Capacity of Additional Satellite - Downstream (Gbps)	78	94	112	135	162	194	233	279	335	402
ViaSat Satellite Capacity										
New Satellites Launched	1	-	-	1	-	1	-	1	-	1
Added Capacity in Orbit (Gbps)	78	-	-	135	-	194	-	279	-	402
Cummulative Capacity in Orbit (Gbps)	78	78	78	213	213	407	407	686	686	1,089
Other Satellite Industry Capacity										
New Satellites Launched		1	-	-	1	-	1	-	1	-
Added Capacity in Orbit (Gbps)	-	78	-	-	162	-	233	-	335	-
Cummulative Capacity in Orbit (Gbps)	-	78	78	78	240	240	473	473	808	808
Satellites In Orbit	1	2	2	3	4	5	6	7	8	9
Total Downlink Satellite Capacity	78	156	156	291	453	647	880	1,159	1,494	1,897
Adjust Total for Imperfect Fill (90%)	70	140	140	262	407	582	792	1,043	1,345	1,707
Capacity Needed (OBI TP 1 Medium Usage Scenario)										
Per Sub Capacity Required (kbps)	62	79	100	126	160	203	258	260	260	260
Housing units that can be served (Millions)	1.138	1.777	1.399	2.077	2.545	2.864	3.067	4.012	5.173	6.566
Capacity Needed (OBI TP 1 High Usage Scenario)										
Per Sub Capacity Required (kbps)	178	225	285	360	455	578	734	734	734	734
Housing units that can be served (Millions)	0.394	0.624	0.493	0.728	0.895	1.007	1.078	1.421	1.832	2.326
Satellite Capital Expenditure Analysis										
Total Satellite Capital Investment (millions)	$400	$800	$800	$1,200	$1,600	$2,000	$2,400	$2,800	$3,200	$3,600
Satellite CapEX/subscriber (Medium Usage Scenario)	$351	$450	$572	$578	$629	$698	$782	$698	$619	$548
Satellite CapEX/effective housing unit passed 83% take rate	$292	$374	$474	$480	$522	$580	$649	$579	$513	$455
Satellite CapEX/effective housing unit passed 67% take rate	$235	$302	$383	$387	$421	$468	$524	$468	$414	$367
Satellite CapEX/subscriber (High Usage Scenario)	$1,014	$1,282	$1,623	$1,649	$1,787	$1,985	$2,225	$1,970	$1,746	$1,548
Satellite CapEX/effective housing unit passed 83% take rate	$842	$1,064	$1,347	$1,369	$1,483	$1,648	$1,847	$1,635	$1,449	$1,285
Satellite CapEX/effective housing unit passed 67% take rate	$680	$859	$1,087	$1,105	$1,197	$1,330	$1,491	$1,320	$1,170	$1,037

The independent variables in this spreadsheet are those in the lightly shaded region and the 83% and 67% take rates. All other values are calculated from those values.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Satellite CapEx/subcriber (medium usage scenario)	$351	$450	$572	$578	$629	$698	$782	$698	$619	$548
Other Upfront Investments	$715	$710	$705	$700	$695	$690	$685	$680	$675	$670
Present Value Factor	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
Operating Expense	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Present Value of Operating Expense	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371
Present Value of All Investment and Costs(medium usage)	$3,437	$3,531	$3,647	$3,648	$3,694	$3,759	$3,838	$3,748	$3,664	$3,589
Monthly Average Revenue per User	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36
Present Value of Revenue	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556
Taxes	$267	$290	$319	$319	$331	$347	$367	$344	$323	$305
Subsidy Required	$148	$265	$411	$412	$469	$550	$649	$537	$432	$338
Satellite CapEx/subcriber (high usage scenario)	$1,014	$1,282	$1,623	$1,649	$1,787	$1,985	$2,225	$1,970	$1,746	$1,548
Other Upfront Investments	$715	$710	$705	$700	$695	$690	$685	$680	$675	$670
Present Value Factor	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
Operating Expense	$24	$24	$24	$24	$24	$24	$24	$24	$24	$24
Present Value of Operating Expense	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371	$2,371
Present Value of All Investment and Costs(medium usage)	$4,100	$4,363	$4,698	$4,720	$4,852	$5,046	$5,281	$5,021	$4,792	$4,588
Monthly Average Revenue per User	$36	$36	$36	$36	$36	$36	$36	$36	$36	$36
Present Value of Revenue	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556	$3,556
Taxes	$432	$498	$582	$587	$620	$669	$728	$663	$605	$554
Subsidy Required	$976	$1,305	$1,725	$1,752	$1,917	$2,159	$2,453	$2,128	$1,841	$1,587

Attachment C

Derivation of the Distribution of Subsidy Requirements

Exhibit 3-H of OBI Technical Paper No. 1 and the essentially identical Exhibit 8-C of the National Broadband Plan show the cumulative distribution of the subsidies required to close the broadband gap versus the percentage of housing units served. Exhibit 3-H is reproduced below. The least expensive housing units require relatively little subsidy, the last 25 or 30% of housing units require substantial subsidies.

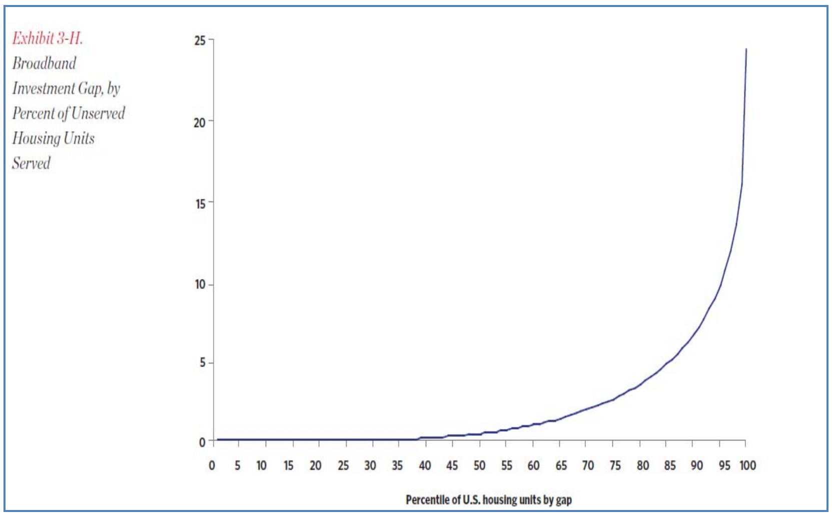

Figure C-2. Exhibit 3-H from OBI Technical Paper No. 1 "Cumulative Distribution of the Broadband Gap"

This graph does not allow one to see directly how much subsidy is required by a particular group of households. That information may be in the supporting materials released by OBI but we did not find it. However, one can find that information from the figure. We did that by reading off the values of the cumulative distribution at the 40th percentile, the 45th percentile, the 50th percentile, and so on all the way to the 100th percentile. To do this with some accuracy the figure was imported into Adobe Illustrator and a grid was overlaid on the figure so that values could be read more exactly. So, for example, the investment gap for the first 95% of housing units is approximately $9.3 billion. According to Exhibit 1-A of OBI Technical Paper No. 1, the investment gap for the full 100% is $23.5 billion so we used that value for the 100-percentile value.

If those readings from the figure are correct then the 5% of housing units lying between the 95th and the 100th percentile must require a total subsidy of 23.5-9.3 = $14.2 billion. We know that there are 7 million housing units in the gap so 5% of 7 million is 350,000. Dividing $14.2 billion by 350,000 gives $40,571—the average cost per housing unit of closing the last 5% of the broadband gap is $40,571.

However, we wanted finer resolution than we could easily get by reading the figure. So, we fit a cubic spline to the data points we had read off and interpolated for the values of the cumulative cost curve at every 1% point between 40% and 100%. Doing so indicated that the 1% of housing units (a total of 70,000 units) between the 80th and the 81st percentiles were calculated to need a total subsidy of $247 million or a subsidy of $3,525 each. This process is not perfect but, in the absence of access to the underlying data, does generate a reasonable estimate of the average per housing unit costs in each percentile.

As a check we used our derived costs to generate a cumulative cost distribution like the one in OBI Technical Paper No. 1 Exhibit 3-H and graphed the distribution. We then overlaid a plot of our distribution on Exhibit 3-H. That overlay is shown in Figure 2. As one can see our cumulative distribution matches quite closely the cumulative distribution in Exhibit 3-H except for the region between the 95th and the 100th percentile where our distribution rises more quickly in the range from about the 95th to the 98th percentile but then rises more slowly for the rest of the way. Nevertheless, this plot gives one great confidence that our derived cost distribution closely matches the cost distribution used by OBI to generate Exhibit 3-H. The dark blue line is the curve from OBI Technical Paper 1, the light blue line is the reproduction from our data.

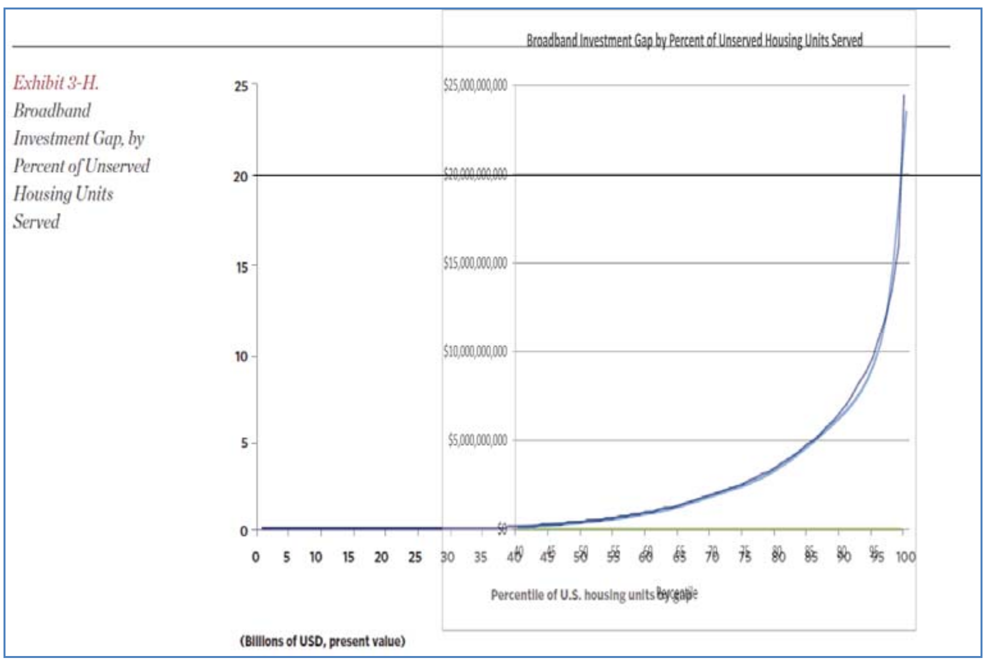

Figure C-3. Overlay of Derived Cumulative Distribution on Exhibit 3-H

Figure C-3 plots the required per household subsidy in one-percent steps from the 40th percentile on up. Table C-1 below shows our derived values for the average subsidy needed for all the single percent intervals from 40-41 to 99-100. As another check, we can calculate using the numbers in the table below that the average subsidy needed for most expensive three percent of unserved housing units or the most expensive 210,000 housing units is ($39,994 + $57,143 + $64,286) / 3 = $53,807. OBI Technical Paper No. 1 states that "the highest-gap 250,000 housing units account for $13.4 billion of the total $23.5 billion investment gap."[40] This is an average cost of $13.4 billon / 250,000 = $53,600. That is the average cost for the most expensive 250,000 housing units is almost the same as our estimated cost for the most expensive 21,000 units—but is actually slightly lower as would be expected.

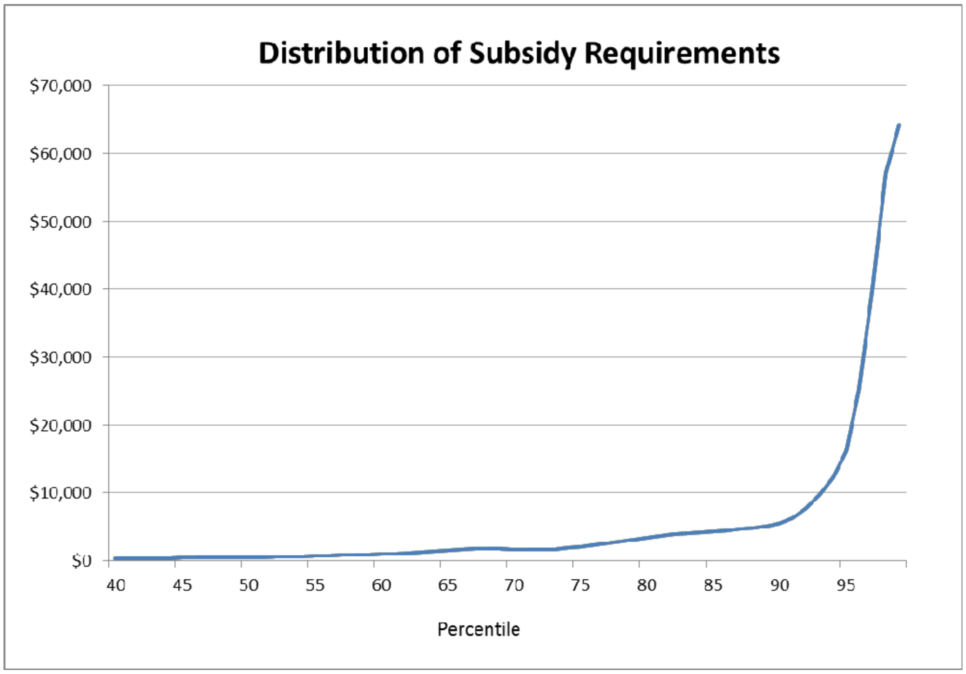

Figure C-4. Distribution of Per-Housing Unit Subsidy Requirements

Table C-1. Subsidy Requirements Per Housing Unit

Interval Lower Boundary Percentile	Average Subsidy per Housing Unit
40	$389
41	$391
42	$397
43	$406
44	$417
45	$431
46	$445
47	$458
48	$470
49	$482

40 OBI Technical Paper No. 1 at p. 5.

Interval Lower Boundary Percentile	Average Subsidy per Housing Unit
50	$495
51	$520
52	$558
53	$609
54	$674
55	$749
56	$815
57	$869
58	$911
59	$942
60	$968
61	$1,021
62	$1,108
63	$1,230
64	$1,387
65	$1,564
66	$1,697
67	$1,772
68	$1,790
69	$1,748
70	$1,669
71	$1,631
72	$1,653
73	$1,737
74	$1,882
75	$2,080
76	$2,306
77	$2,551
78	$2,817
79	$3,103
80	$3,398
81	$3,666
82	$3,895
83	$4,087
84	$4,240
85	$4,366
86	$4,511
87	$4,685

Interval Lower Boundary Percentile	Average Subsidy per Housing Unit
88	$4,888
89	$5,121
90	$5,474
91	$6,309
92	$7,714
93	$9,691
94	$12,240
95	$16,238
96	$25,197
97	$39,994
98	$57,143
99	$64,286

Exhibit B

AN ANALYSIS OF THE BENEFITS OF ALLOWING SATELLITE BROADBAND PROVIDERS TO PARTICIPATE DIRECTLY IN THE PROPOSED CAF REVERSE AUCTIONS

Jonathan Orszag and Bryan Keating

April 18, 2011

CONTENTS

I. Qualifications

1. My name is Jonathan Orszag. I am a Senior Managing Director and member of the Executive Committee of Compass Lexecon, LLC, an economic consulting firm. My services have been retained by a variety of public-sector entities and private-sector firms ranging from small businesses to Fortune 500 companies. These engagements have involved a wide array of matters, from telecommunications and entertainment issues to issues affecting the retail and sports industries. I have provided testimony to administrative agencies, the U.S. Congress, U.S. courts, the European Court of First Instance, and other domestic and foreign regulatory bodies on a range of issues, including competition policy, industry structure, and fiscal policy. Previously, I served as the Assistant to the U.S. Secretary of Commerce and Director of the Office of Policy and Strategic Planning and as an Economic Policy Advisor on President Clinton's National Economic Council. I am a Fellow at the University of Southern California's Center for Communication Law & Policy and a Senior Fellow at the Center for American Progress. I received a M.Sc. from Oxford University, which I attended as a Marshall Scholar. I graduated summa cum laude in economics from Princeton University, was elected to Phi Beta Kappa, and was named to the USA Today All-USA College Academic Team. I have been active in applied analysis of issues affecting the telecommunications sector. While I served in the federal government, I worked on a number of policy issues involving broadband deployment and the so-called digital divide. Since leaving government, I have submitted testimony to the Federal Communications Commission and other regulators regarding mergers and regulatory matters affecting the

telecommunications sector. I have also contributed to the literature regarding the consumer benefits associated with broadband deployment.[1]

2. My name is Bryan Keating. I am a Vice President at Compass Lexecon. I received my Ph.D. in economics from Stanford University in 2007. At Compass Lexecon, I have conducted economic and econometric analysis in support of litigation, arbitration/settlement discussions, and efforts to secure regulatory approval for mergers. I have substantial experience designing and implementing complex econometric models using large-scale databases, especially in industries that involve differentiated products. I have analyzed issues relating to market definition, competitive effects, welfare analysis and merger simulation in a wide variety of industries including telecommunications, consumer products, computer software and hardware, airlines, health care, payment cards, and sports.

II. Introduction and Overview

3. The Federal Communications Commission ("the Commission") has issued a Notice of Proposed Rulemaking ("NPRM") proposing fundamental modifications to the existing Universal Service Fund ("USF") and Intercarrier Compensation ("ICC") rules.[2] These modifications are designed to facilitate the goals of the National Broadband Plan to make

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[1] *See* Mark Dutz, Jonathan Orszag, and Robert Willig, "The Substantial Consumer Benefits of Broadband Connectivity for U.S. Households," July 2009, available at http://internetinnovation.org/files/special-reports/CONSUMER_BENEFITS_OF_BROADBAND.pdf (site visited April 15, 2011) (hereinafter *Dutz, Orszag and Willig (2009)*).

[2] *In the Matter of Connect America Fund, A National Broadband Plan for Our Future, Establishing Just and Reasonable Rates for Local Exchange Carriers, High-Cost Universal Service Support, Developing an Unified Intercarrier Compensation Regime, Federal-State Joint Board on Universal Service, Lifeline and Link-Up,* WC Docket No. 10-90, GN Docket No. 09-51, WC Docket No. 07-135, WC Docket No. 05-337, CC Docket No. 01-92, CC Docket No. 96-45, WC Docket No. 03-109, Notice of Proposed Rulemaking and Further Notice of Proposed Rulemaking, February 8, 2011 (hereinafter *CAF NPRM*).

affordable broadband services available to all Americans.[3] The Commission proposes to create a Connect America Fund ("CAF"), which would focus on broadband deployment and would ultimately replace the existing high-cost USF programs.[4] In connection with the proposed CAF, the Commission seeks comment on "using a competitive bidding mechanism to award funding to one provider per geographic area in all areas designated to receive CAF support."[5] While the Commission proposes to exclude satellite broadband from direct participation in the first phase of the CAF, for the second stage the Commission seeks comment on what approach "might be best suited to making the best use of satellite capacity with competitive bidding."[6] We have been asked by counsel for ViaSat, Inc. ("ViaSat") to evaluate the likely benefits of permitting satellite broadband providers to participate fully and directly in any reverse auctions used to allocate support from the proposed CAF.

4. We agree with the Commission's goal of deploying broadband more broadly. Previous research has shown broadband adoption generates large consumer benefits.[7] Unserved households are likely to benefit significantly from the expansion of broadband networks. To support these goals, and reduce the size of the CAF and the resulting contribution burden, the Commission should seek to implement reforms that distribute CAF funding as efficiently as possible.

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[3] *CAF NPRM*, § I.

[4] *CAF NPRM*, ¶ 15.

[5] *CAF NPRM*, ¶ 418.

[6] *CAF NPRM*, ¶ 427.

[7] See Dutz, Orszag and Willig (2009).

5. Based on our research and analyses, we have reached the following conclusions:

- Allowing satellite broadband providers to participate fully and directly in the reverse auctions used to allocate support from the CAF will serve to lower significantly the funding requirements and generate more attractive build-out and service commitments. Conversely, excluding satellite broadband providers from directly participating in the reverse auctions would undermine the Commission's objective of efficiently distributing limited funding.

- Satellite providers could deploy enough capacity, by 2020, to serve more than six million households, even after taking into account the expected increase in bandwidth usage predicted by the Commission. Satellite broadband providers would be able to serve an even higher percentage of households that *want* broadband service, factoring in the expected rate of adoption by the unserved. Furthermore, for at least 47 percent of the seven million unserved housing units, it would be significantly less costly to close the investment gap with satellite broadband than it would be to do so with other technologies.[8]

- Direct participation by satellite broadband providers in the proposed auctions will generate economies of scale that will benefit consumers, both in their capacity as broadband users and in their capacity as contributors to the CAF. These benefits will extend even to areas where satellite broadband does not receive CAF funding. Conversely, excluding satellite broadband from direct participation while

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8 Chuck L. Jackson, "Satellite Service Can Help to Effectively Close the Broadband Gap," April 18, 2011 (hereinafter *Jackson Report*) at 23.

simultaneously subsidizing satellite competitors is likely to undermine competition and harm consumers. Due to the large fixed costs of deploying satellite networks, exclusion from the CAF could disincentivize satellite broadband providers from launching additional satellites, which would harm consumers in unserved areas as well as in underserved areas. As a result, by excluding satellite broadband providers today, the Commission may end up increasing the costs of providing service to unserved and underserved households in the future, which would run directly counter to the Commission's stated policy goal.

- Allowing satellite broadband providers to partner with existing voice networks and directly bid in reverse auctions as a "prime" bidder will generate significant efficiencies.

6. A fundamental principle of the proposed reforms to the USF and ICC rules is that universal service support should be competitively and technologically neutral.[9] That is, the government should not be in the business of picking technological winners and losers. As a group of economists recently noted:[10]

> "…this auction must be designed in a way that does not arbitrarily benefit one technology over another. Organizations could, therefore, bid to upgrade copper services in order to make DSL feasible, upgrade or install coaxial cable to

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[9] *CAF NPRM*, ¶ 82 ("We also request comment on how we should weigh other section 254(b) principles, including the principle that universal service support should be competitively neutral, which the Commission adopted pursuant to section 254(b)(7). We believe our proposal to support broadband is competitively neutral because it will not unfairly advantage one provider over another or one technology over another.") (internal citations omitted).

[10] See Paul Milgrom, Gregory Rosston, Andrzej Skrzypacz and Scott Wallsten, "Comments of 71 Concerned Economists: Using Procurement Auctions to Allocate Broadband Stimulus Grants," *USF Reform NOI/NPRM*, 25 FCC Rcd at 6704, App. B, April 13, 2009 (submitted to NTIA and Rural Utilities Service) (hereinafter *Economists' Letter*) at 5.

> facilitate cable broadband, or upgrade or install wireless and satellite broadband equipment."

Indeed, the idea that competition between private firms best promotes public welfare dates back to the work of Adam Smith in the 18th century. Government intervention should generally only occur in the presence of clear market failure and even then should be implemented only when the benefits of the government intervention exceed the costs. Furthermore, the government should seek to intervene in private markets in the most efficient way possible and to do so in such a way as to encourage competition between private firms.

7. By excluding satellite broadband providers from direct participation in the proposed auctions, the Commission would unambiguously violate its own stated principle, and would do so in a way that disadvantages firms that would be the most cost-effective in serving many high-cost areas, leading to substantially higher costs and lower efficiency. Indeed, the Commission explicitly recognizes the value of satellite broadband:

- "The optimal role could be in . . . ensuring that satellite can function as a ubiquitous bidder in a range of auctions."[11]
- "currently unserved areas may be more economically served by satellite."[12]
- "there could be benefits in terms of the size and efficiency of the CAF if our rules were designed to support the use of satellite."[13]

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11 *OBI Technical Paper No. 1* at 40.

12 *CAF NPRM*, ¶ 428.

13 *CAF NPRM*, ¶ 424.

It would be both counterintuitive and counterproductive to exclude the firms that may be most efficient from a process designed to further the Commission's broadband goals at the lowest possible cost.

8. The Commission's main concern with allowing satellite broadband providers to participate directly in the proposed auctions appears to be perceived capacity constraints and build-out times associated with satellite broadband.[14] As we discuss in more detail below, it appears that the Commission underestimates the capacity of the satellites that could be constructed within the implementation period contemplated for all CAF participants. Particularly given that no technology currently is in place to serve all of the unserved (by definition—there is no current coverage of the unserved), the Commission should not introduce inefficiencies into the auction process by disfavoring one particular technology based on its state of actual deployment today.

9. The remainder of this paper explains these findings in greater detail and describes the facts and economic analyses that led us to reach them.

III. Allowing Satellite Broadband to Participate Directly Will Improve the Efficiency of the Proposed Reverse Auctions

10. Procurement auctions (also referred to as "reverse" auctions) represent a quick and efficient mechanism for distributing support based on a well-defined set of rules.[15] In a simple procurement auction, the purchaser (in this case the government, which is seeking bids to

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14 *CAF NPRM*, ¶ 272 ("[W]hile satellite broadband can serve (almost) any particular unserved housing unit in an area, it does not appear that existing and expected satellite capacity will be sufficient to serve all unserved housing units in the United States over the next few years at projected usage levels.").

15 *Economists' Letter* at 3-4.

extend broadband deployment and provide service in unserved areas) specifies the item to be bid on with some level of objective detail. For example, the object could be the provision of broadband service of some minimum level of quality in a well-defined geographic area at a defined monthly cost of service to the end user. Firms then submit bids and the government picks the best bid. The Commission uses similar types of auctions to distribute spectrum and other government agencies use procurement bids to acquire complex products such as weapons systems.[16] Auctions rely on competition between bidders to set the appropriate price (in this case the price paid by the government). Firms participating in the auction formulate bids based on a variety of factors including their own costs as well as expectations about the participation and bids of other firms.

11. Auctions have several advantages over the traditional grant-making process.[17] First, the traditional process can place substantial administrative burdens on applicants required to submit lengthy applications. Second, due to the qualitative nature of the process, decisions can be unpredictable, making it more difficult for companies to plan. Third, it can be difficult to design a process that results in the lowest possible subsidy. Reverse auctions can address many of these issues by setting forth clear objectives and relying on competition to determine the optimal subsidy. Auctions can also eliminate rent-seeking behavior – which can result in inefficient allocations – by defining clear, technology-neutral, and transparent rules for picking winners.

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[16] *Economists' Letter* at 3.

[17] *Economists' Letter* at 2.

12. In the first phase of the CAF, the Commission proposes to test the use of reverse auctions as a means of distributing ongoing CAF support.[18] The Commission proposes to make support available to at most one provider in each geographic area.[19] Unserved areas would be defined based on census blocks and support would be distributed based on bidders' aggregations of census blocks.[20]

13. In the first phase, the Commission proposes to exclude satellite distributors as direct participants in the auctions and rather allow wireline and wireless bidders to use satellite providers as those other bidders deem appropriate to fill in gaps in coverage.[21] Nonetheless, the Commission recognizes the value of satellites in fulfilling its goals and considers several alternative approaches for the second phase of the CAF:[22]

- Allowing satellite broadband providers to participate directly in the auction by bidding on geographic areas in the same manner as other technologies, including using satellites that have not yet been designed;[23]

- Allowing satellite broadband providers to participate directly in the auction but limiting their participation to bidding based on per-housing-unit prices for a maximum

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18 *CAF NPRM*, ¶ 266.

19 *CAF NPRM*, ¶ 268.

20 *CAF NPRM*, ¶ 269.

21 *CAF NPRM*, ¶ 271 ("We propose that providers eligible to compete for support be allowed to deploy terrestrial wireline or wireless (including using unlicensed spectrum) technologies, and to allow such firms to partner with satellite broadband providers to fill in gaps in coverage.").

22 *CAF NPRM*, ¶ 425 ("A judicious use of support for satellite service could reduce costs associated with building out networks.").

23 *CAF NPRM*, ¶ 425.

number of housing units within a geographic area that is defined by spot beams on existing satellites.[24]

For the second phase of the CAF, the Commission also is considering:

- Excluding satellite broadband providers from direct participation in the auction, but allowing wireline and wireless bidders to resell the service of satellite broadband providers in those areas chosen by the terrestrial bidders;[25] or

- Limiting support for any given line to the amount that would be needed to serve that line with satellite service.[26]

14. As discussed below, allowing direct and full satellite participation in both phases of the CAF and in all of the reverse auctions is likely to result in substantially lower funding commitments and enhanced quality of service for consumers relative to alternatives in which satellite participation is limited.

A. Greater competition will lower the cost of the CAF and the corresponding contribution burden on consumers

15. Auctions depend on competition to determine prices.[27] Greater competition in a procurement auction can lead to lower prices. The Commission itself has recognized the value

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[24] *CAF NPRM*, ¶ 426.

[25] *CAF NPRM*, ¶ 427.

[26] *CAF NPRM*, ¶ 424.

[27] We understand that the Commission has not decided on the format of its auction. *CAF NPRM*, ¶ 331.

of competition in limiting the amount of support allocated.[28] At the extreme, if only one firm participates in an auction, that firm will be constrained only by what it believes is the maximum subsidy the government is willing to offer. In private value procurement auctions with symmetric bidders, increasing the number of bidders decreases the cost to the purchaser.[29] This is so for two reasons. First, all else being equal, an increased number of bidders make it more likely that a low-cost bidder participates. Second, in certain auction formats, when deciding what value to bid, bidders must balance the likelihood that they will win (by submitting a relatively low bid) against the lower revenues they would get by submitting the lower bid. As more bidders participate, bidders must bid more aggressively to maintain some chance of winning the auction.[30]

16. Under more general assumptions, this relationship may not always hold.[31] Therefore, it is important to examine empirical evidence to determine the effect of competition on prices.

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28 *CAF NPRM*, ¶ 419 ("Because bidders would be in direct competition with bidders in every area in the nation where support is offered, they should have incentives to limit the amount of support they seek.").

29 R. Preston McAfee and John McMillan (1987), "Auctions and Bidding," *Journal of Economic Literature*, 25:2, 699-738.

30 In a second price auction where the winning bidder pays the bid of the second best bidder, each bidder has incentive to bid its true valuation. With only one bidder, the bidder would bid its true valuation and receive the maximum allowable subsidy. With a second bidder, the winning bidder will pay the bid of the second bidder rather than the maximum allowable subsidy. Similarly, with more than two bidders, adding an additional bidder increases the chances that the new bidder will enter either the first or second lowest bid, hence decreasing the cost to the purchaser.

With a first price auction, the winning bidder pays its bid. Bidders must balance the likelihood of winning (by entering a low bid) against the potential revenues that they would earn by entering a higher bid. Bidders facing greater competition will increase their bids to increase the likelihood of entering the lowest bid.

31 Bulow and Klemperer (1996) demonstrate conditions under which increasing the number of bidders benefits the seller (or buyer in a procurement auction). But Bulow and Klemperer (2002) show that this intuition is more likely to be true in private-value auctions and less likely to be true in common-value or almost common-value auctions where the winner's curse can induce bidders to shade their bids. Jeremy Bulow and Paul Klemperer (1996), "Auctions Versus Negotiations," *American Economic Review*, 86:1,

The most relevant empirical evidence for the CAF comes from USF auctions in other countries; this evidence supports the notion that greater competition will lead to lower subsidies. For example, Wallsten (2008) examines the results of reverse USF auctions in Australia, Chile, Colombia, India, Nepal, and Peru.[32] He concluded that "most of these reverse auctions have been successful in reducing expenditures on universal service."[33] In several cases, competition reduced the winning bid. For example, in India, Wallsten concluded that "[t]hese auction results demonstrate strongly that competition can bring down the subsidy." Similarly, the absence of competition can increase the winning bids, which increases the burden on the consumers that contribute to USF. For example, in Chile "[t]he dominant local firm bid 100% of the maximum subsidy in areas with no competitors which were close to its existing network, 90% of the maximum subsidy in areas with an emerging competitor, and zero in areas with strong competition."

17. Even if satellite broadband providers do not win a given auction, their direct participation could induce other bidders to bid more aggressively.[34] Empirical research shows

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180-194; Jeremy Bulow and Paul Klemperer, "Prices and the Winner's Curse," *The RAND Journal of Economics*, 33:1, 1-21.

Similarly, in a multi-unit Vickrey auction in which the goods are complements for at least some bidders, greater competition could reduce revenue (in a standard auction) or increase costs (in a reverse auction). Nonetheless, under many circumstances, the "monotonicity" condition does hold. See Paul Milgrom, *Putting Auction Theory to Work*, Cambridge University Press, Cambridge, 2004, Chapter 8.

32 Scott Wallsten (2008), "Reverse Auctions and Universal Telecommunications Service: Lessons from Global Experience," *Federal Communications Law Journal*, 61:2, 373-394.

33 Wallsten (2008) notes that, "[i]n two cases the auctions did not reduce expenditures (Australia, and the first and second auctions in India), but even there, expenditures were not more than they would have been without an auction."

34 This conclusion depends on the auction format. For example, in second-price auctions, it is a dominant strategy for each bidder to bid its own valuation. Nonetheless, participation by satellite firms could

that in USF auctions in other countries, where the incumbent provider won, it did so with a lower bid in areas where it faced more competition.[35] For example, in India, Wallsten (2008) concluded:[36]

> "The following three auctions were more successful, attracting additional firms and yielding better outcomes. While the incumbent won one of those three auctions and parts of the other two, private providers won parts of two auctions, and *the subsidies in all three auctions were well below the benchmark amounts*."

The evidence in Chile is also consistent with this effect, as again the dominant local firm bid less in areas where it faced more competition.

18. Allowing satellite broadband providers to participate only indirectly, essentially as subcontractors of wireline or wireless carriers, would not generate the same competitive benefits. By eliminating certain potential bidders from directly participating in the auction, especially bidders with a low cost structure, such an approach would eliminate incentives for the remaining bidders to bid as aggressively.[37] At the extreme, suppose only one firm other than the satellite broadband provider had the potential to participate in the auction. By excluding the satellite firm from direct participation, the remaining firm would be constrained only by what it believed the maximum possible subsidy to be. This approach would lead to higher bids from the remaining bidders, all else being equal, and result in greater profits for

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lower the subsidies paid by the auction because of the positive probability that a satellite firm would enter the first- or second-lowest bid.

35 Wallsten (2008).

36 Wallsten (2008) (emphasis added).

37 As discussed above, auction theory does not provide general guidance on this question, but the most relevant empirical evidence supports this claim.

those bidders. Under a reverse auction format, that firm would not need to justify its costs. In such a situation, the "prime" funding recipient could resell low-cost satellite service, without lowering its bid at all, and certainly without lowering its bid to the same extent as it would if it faced direct competition from the satellite provider in the auction process. It could therefore obtain large subsidies and generate private gains at public expense.

B. Satellite broadband can provide high-quality service promptly and at lower costs than terrestrial competitors

19. In Summer 2011, ViaSat will launch the ViaSat-1 satellite.[38] ViaSat-1 is a high-capacity Ka-band spot beam satellite that is expected to have the highest capacity in the world, with an estimated U.S. capacity of 130 Gbps.[39] ViaSat-1 is designed to provide subscribers with "a broadband experience that is very comparable to terrestrial services."[40] It will enable ViaSat to offer offer a variety of service offerings that meet or exceed the Commission's proposed 4 Mbps download/1 Mbps upload standard.[41]

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[38] ViaSat Inc., Press Release, "ViaSat Reschedules Lauch of ViaSat-1," January 13, 2011, available at http://www.viasat.com/news/viasat-reschedules-launch-viasat-1 (site visited April 14, 2011).

ViaSat's competitor Hughes, is expected to launch the Jupiter spacecraft in the first half of 2012. This spacecraft will have a capacity of over 100 Gbps and will enable download speeds of 1 to 5 Mbps. http://www.hughes.com/ProductsAndTechnology/Jupiter/Pages/default.aspx (site visited April 14, 2011).

[39] ViaSat Inc., Press Release, "ViaSat Reschedules Lauch of ViaSat-1," January 13, 2011, available at http://www.viasat.com/news/viasat-reschedules-launch-viasat-1 (site visited April 14, 2011).

[40] ViaSat Inc., "Meeting the Demand for Media-Enabled Satellite Broadband," available at http://www.viasat.com/files/assets/Broadband%20Systems/MediaEnabledSatellite9-09.pdf (site visited April 14, 2011).

[41] See November 2, 2010 Letter. See also ViaSat, "ViaSat to Demo Next Generation Satellite Broadband Service with Highest Speeds Ever Offered by the Platform at Satellite 2009, available at http://investors.viasat.com/releasedetail.cfm?releaseid=372564 (site visited April 14, 2011) ("Once operational, ViaSat-1 will offer 2-10 Mbps, or higher, download speeds at retail prices competitive with comparable terrestrial services.")

20. ViaSat-1 and its associated ground network cost approximately $400 million to develop, build and launch.[42] Under reasonable sets of assumptions, the capital expenditure per subscriber is approximately $1,324 (including the cost of non-satellite capital expenditures and other upfront investments).[43] Once one adds in operating expenses, the total net present value of the cost of extending satellite broadband to the unserved is approximately $3,694 per household served based on the Commission's medium use scenario in 2015.[44] The incremental cost for reaching additional subscribers generally does not depend on that subscriber's location.

21. Furthermore, the cost of launching new satellites has tended to stay relatively constant as the capabilities have increased. As a result, the cost of providing satellite capacity (per Mbps) has declined at a rate of 20 percent per year.[45] Thus, it is reasonable to expect that, on a quality-adjusted basis, future spacecraft will be even less expensive than the generation of spacecraft about to be launched.

22. In contrast, the costs of alternative technologies are higher, at least in some geographic areas. For example, using the 4 Mbps baseline case, the Commission estimates that the total cost of serving all seven million unserved housing units with 12,000-foot DSL would be $26.2 billion ($3,743 per household) and with 4G wireless would be $18.3 billion ($2,614 per

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42 Information provided by ViaSat, Inc.

43 *Jackson Report* at 15. In 2015, satellite capital expenditures per subscriber are estimated to be $629 and other upfront investments are estimated to be $695.

44 *Jackson Report* at 15, Table 6.

45 *Jackson Report* at 10.

household).[46] The costs of fiber-to-the premises (FTTP) as well as 3,000-foot and 5,000-foot DSL are even greater than that.[47] Unlike satellite broadband, the costs of deploying wireline and wireless broadband are more likely to depend on location, with more rural locations likely to cost substantially more than the averages reported here.[48] For example, the costs for fixed wireless and 12,000-foot DSL are many times higher in the least dense census blocks relative to the most dense census blocks.[49]

23. Thus, in many geographic areas, and for about 47 percent of the seven million unserved housing units, it is reasonable to expect that satellite broadband would be the lowest cost provider.[50] The Commission has recognized this fact, noting that "currently unserved areas may be more economically served by satellite."[51] Excluding satellite broadband from full and direct participation in the proposed auctions will likely lead to substantially higher costs both because this will limit the degree of competition in the auctions and it eliminates potentially low-cost bidders. This is particularly true because, as we discuss in the next section, the Commission appears to overstate the extent to which satellite broadband will face future capacity constraints.

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46 *OBI Technical Paper No. 1* at Exhibit 3-M. While AT&T and Verizon have announced widespread roll-outs of 4G networks, the Commission assumes that some incremental investment would be needed to extend those networks to all unserved households. National Broadband Plan at 137.

47 *OBI Technical Paper No. 1* at Exhibit 3-M. 3,000- and 5,000-foot DSL achieve much faster speeds by deploying fiber closer to the end user.

48 *OBI Technical Paper No. 1* at Exhibit 4-C.

49 *OBI Technical Paper No. 1* at Exhibit 4-C.

50 *Jackson Report* at 17.

51 *CAF NPRM*, ¶ 428.

C. *Satellite broadband providers are no more capacity constrained than proponents of other technologies who would need to construct new facilities to extend service*

24. Satellite capacity depends primarily on the amount of spectrum available and the ability to reuse that spectrum by increasing the number of spot beams.[52] Spot beams allow a satellite to reuse spectrum capacity through the geographic separation of spot beams using the same spectrum. ViaSat-1 is a Ka-Band satellite with 1500 MHz of spectrum. Each spot beam uses a portion of this spectrum. ViaSat-1 will have 63 spot beams dedicated to providing coverage to end users in the United States. Each spot beam covers a geographic area with an approximate 200 mile diameter. ViaSat-1 is designed to offer continuous geographic coverage to the eastern half of the United States, the west coast, as well as Denver, Phoenix, Tucson, and parts of Alaska and Hawaii. ViaSat-1 also has a number of gateway beams focused on the middle of the country which link to gateway ground stations and ultimately connect users to the Internet backbone. ViaSat-1 covers approximately 60 percent of the land area in the United States and 80 percent of the population.

25. ViaSat-1 will have a total U.S. capacity of 130 Gbps.[53] Assuming an average download speed of 4 Mbps and an average upload speed of 1 Mbps, ViaSat-1 will have the capacity to serve approximately 0.44 million subscribers in 2015 based on the Commission's baseline assumption for increased provisioning rates between today and 2015.[54]

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52 Information in this paragraph is based on an interview with ViaSat executives on April 9, 2011.

53 ViaSat Inc., Press Release, "ViaSat Reschedules Lauch of ViaSat-1," January 13, 2011, available at http://www.viasat.com/news/viasat-reschedules-launch-viasat-1 (site visited April 14, 2011).

54 *Jackson Report* at 6.

26. Overall, satellite capacity can be increased via several mechanisms. First, firms can launch more satellites. There is no binding constraint on the number of satellites that can be launched if sufficient demand is available to support them. As is the case today with the direct broadcast satellite (DBS) industry, multiple satellites could be located at the same orbital location. While the number of orbital arc locations suitable for serving the United States is approximately 30 to 40 in any given spectrum band, only about ten of those possible locations are accounted for by current or planned Ka-band satellites.[55] Even so, much of the Ka-band is not being used at any of those locations. Furthermore, additional spectrum in the 17/24 GHz and 40/50 GHz range is unused, suggesting that spectrum constraints also are not binding. Given the lack of constraints, it is reasonable to assume that the satellite industry could launch a new satellite every year starting in 2014.[56] In this respect, we note that since its inception in the mid-1990s, the satellite television industry has launched more than two dozen DBS satellites.[57]

27. Second, the capacity of any given satellite can be increased either by increasing the amount of spectrum available for its use, narrowing the size of the spot beams and fitting additional spot beams on the satellite, or improving other protocols and signal processing methods. Indeed, much of this technology is already known today and likely to find its way onto the next generation of broadband satellites.[58]

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55 *Jackson Report* at 5 n.8.

56 *Jackson Report* at 12-13.

57 *Jackson Report* at 12 n.32.

58 *Jackson Report* at 4-6.

28. Satellite technology has kept pace with growth in bandwidth demands over last 20 years and this trend is likely to continue. Since the launch of the Westar 1 in 1974, with a capacity of 144 Mbps, the capacity of a single satellite has grown at a rate of approximately 20 percent per year.[59] ViaSat believes that this trend will continue.[60] Therefore, we should expect future satellites to offer substantially more capacity than the generation to be launched within the next year.

29. While it is true that existing satellites do not have the capacity to serve all unserved housing units, this is also true of existing wireline and wireless infrastructure, by definition. Any recipients of CAF funds would have to build out capacity. Wireline operators would have to build out lines and other infrastructure. Wireless carriers would have to build towers and put in place other equipment. Satellite broadband providers would have to launch additional satellites. The NPRM contemplates requiring three-year build out commitments.[61] Our understanding is that the production cycle for launching new satellites is approximately 30-36 months, suggesting that satellite broadband providers could just as easily meet the buildout requirements as other potential bidders.[62]

30. Under reasonable assumptions reflecting long-running trends, the satellite industry could reasonably serve more than six million broadband housing units by 2020, even

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59 *Jackson Report* at 4-6.

60 Interview with ViaSat Executives on April 9, 2011.

61 *CAF NPRM*, ¶ 24.

62 *Jackson Report* at 6. If satellite broadband providers use existing technology, they may be able to launch satellites on a slightly shorter cycle. To the extent that satellite broadband providers compete in and win reverse auctions, this may be a feasible approach.

assuming the increase in bandwidth usage predicted by the Commission.[63] Based on a version of the model used by the Commission to compute the broadband investment gap with appropriate modifications to the assumptions to reflect the satellite industry, the satellite investment gap for 3.3 million (47 percent) of housing units would be about $1.8 billion – substantially lower than the $23 billion dollar gap estimated by the Commission to serve those unserved housing units using terrestrial technology.[64] Satellite broadband providers readily could have this capacity by 2016.[65]

IV. Direct Participation by Satellite Broadband Will Create Economies of Scale

31. Satellite broadband is characterized by large nonlinear fixed costs and relatively low marginal costs. In such industries, economies of scale are particularly important.[66] Economies of scale are characterized by falling average costs as output increases. In the case of satellite broadband, the cost of launching a broadband satellite and implementing the associated ground network is approximately $400 million.[67] In addition, ViaSat incurs other fixed costs. For example, in the year ended April 2, 2010, ViaSat spent at least $27.2 million on independent research and development.[68] Increasing demand for satellite broadband allows

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63 This assumes that the median per sub usage grows in accordance with the assumptions underlying OBI Technical Paper No. 1. *Jackson Report* at 13.

64 *Jackson Report* at 17.

65 *Jackson Report* at 17.

66 Dennis Carlton and Jeffrey Perloff, *Modern Industrial Organization*, 4th Ed., Chapter 3.

67 Information provided by ViaSat, Inc.

68 ViaSat , Inc. Form 10-K for the fiscal year ended April 2, 2010 (hereinafter *ViaSat 10-K*) at 41.

satellite broadband providers to spread these fixed costs over more subscribers, thus lowering the average cost per subscriber.

32. With the launch of ViaSat-1, ViaSat will compete primarily in two segments of the broadband services market: i) areas unserved by wireline broadband (accounting for approximately five percent of households); and ii) underserved areas (accounting for approximately 15 percent of households). Underserved areas have access to some broadband (such as DSL), but not FTTP or high-speed cable broadband. While the current satellites do not offer competitive services in underserved areas, ViaSat expects that starting with the launch of ViaSat-1, it will be able to offer broadband services that are competitive with DSL, wireless, and some cable systems.[69] The current area in which satellite broadband competes is fragmented. Pockets of unserved areas exist even within relatively densely populated areas. In fact, maps of satellite broadband subscribers generally match quite well with population density maps.[70]

33. Because of the existence of large economies of scale, even in areas in which satellite broadband does not receive a subsidy, participation in the CAF would benefit consumers by generating a larger user base over which to spread fixed costs. This large user base, which lowers average costs, creates incentives for satellite broadband operators to invest in new spacecraft and support other service enhancements. In contrast, limiting funding opportunities for satellite broadband providers to extremely high-cost unserved areas, while simultaneously

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69 http://www.viasat.com/broadband-satellite-networks/viasat-1 (site visited April 14, 2011).

70 ViaSat, Inc. and Wildblue Communications, Inc., Notice of *Ex Parte* Presentation, WC Docket No. 10-90; GN Docket No. 09-51; WC Docket No. 07-135; WC Docket No. 05-337; CC Docket No. 01-92; CC Docket No. 96-45; WC Docket No. 03-109, April 11, 2011 at 9.

subsidizing terrestrial competitors in all other unserved areas, could lessen incentives to invest in the next generation of satellite broadband networks — particularly those that would serve unserved and undeserved households in low density areas that are the highest cost to serve with terrestrial technologies.

34. If the Commission chooses to subsidize competitors by excluding satellite broadband providers from directly participating in the reverse auctions, the satellite take rate is likely to be significantly lower, which will reduce satellite fill, and thus drives up the effective cost per user.[71] While the quality of its broadband service will increase with the launch of the next generation of satellites, asymmetric subsidies are still likely to lessen the incentives of satellite broadband providers to invest in future capacity and service improvements.

35. To the extent that the proposed CAF structure would deny direct participation to satellite broadband providers, it would make it less profitable to launch future satellites, hinder broadband expansion, and harm consumers. In particular, potential customers of satellite broadband would be harmed by lack of further development. In addition, terrestrial broadband competitors in underserved areas would face less competition from satellite broadband and therefore would have less incentive to offer better quality of service to consumers. The result would be lower industry output and higher prices than otherwise would occur. While terrestrial broadband providers in underserved areas would gain from the loss of competition, consumers would be harmed.

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71 *OBI Technical Paper No. 1* at 38-39.

V. The Commission Should Allow Any Bidder to Package Multiple Technologies in Making a Bid, Including Satellite Broadband

36. It is efficient to allow operators to partner with each other to provide different types of service (e.g., voice and data). The NPRM suggests that "recipients be permitted to partner with another voice provider, in part, to provide voice capability that meets the definition of 'voice telephony service.'"[72] As an example, the NPRM notes that a funding recipient could "partner" with a satellite voice provider by purchasing and reselling that provider's service. The same logic applies to reciprocal arrangements whereby a satellite provider could be the "prime" bidder and partner with a terrestrial service provider to enhance the capabilities of its satellite offering.

37. It is well established in the economics literature that there are often gains from specialization. Both theory and empirical evidence establish that it can be most efficient for firms to contract with other firms to perform certain functions rather than performing those functions internally.[73] This is so because different entities (individuals, firms, or entire countries) have comparative advantages in some forms of production over others. The logic of comparative advantage suggests that society is better off if each entity produces the good or goods for which it is best suited (i.e., has the lowest opportunity cost). When each firm

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[72] *CAF NPRM*, ¶ 98.

[73] See, e.g., Sanford J. Grossman and Oliver D. Hart (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, 94:4, 691-719 (and papers cited therein); Oliver Hart and John Moore (1990), "Property Rights and the Nature of the Firm," *Journal of Political Economy*, 98:6, 1119-1158.

produces the goods and services that it is best suited to produce and then trade or partner with each other, output is enhanced to the benefit of consumers and society.

38. This same logic can be applied to telecommunications services currently supported by the USF. Existing voice infrastructure already serves many areas that are "unserved" by broadband. For example, the Commission has found that 99.6 percent of the United States population has access to at least one wireless service provider, 98.6 percent have access to two or more wireless service providers, and 95.8 percent have access to three or more.[74] Therefore, there is ample opportunity for satellite providers to partner with existing voice operators to offer packages of voice and broadband services. Preventing a satellite broadband provider from engaging in such partnerships and then directly participating in the auction as a bidder is likely to lead to a misallocation of resources and lower quality of service for customers in unserved areas (and underserved areas as well, as discussed above).

VI. Conclusion

39. Based on the analysis above, we conclude that allowing satellite broadband providers to participate fully and directly in the reverse auctions used to allocate support from the CAF will serve to lower significantly the funding requirements and generate more attractive build-out and service commitments. By ensuring a level playing field across technologies and therefore allowing for competition among broadband providers, such a policy would further the Commission's goals of deploying broadband coverage to all Americans in the most

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[74] *In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993 Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 09-66, Fourteenth Report, May 20, 2010, Table 4.

efficient way possible. Indeed, direct participation by satellite broadband providers in the proposed auctions would also generate economies of scale that will benefit consumers, both in their capacity as broadband users and in their capacity as contributors to the CAF. These benefits would extend even to areas where satellite broadband does not receive CAF funding. Finally, allowing satellite broadband providers to partner with existing voice networks and directly bid in reverse auctions as a "prime" bidder would generate additional significant efficiencies.

Exhibit C

Exhibit C

ViaSat-1 Beam Plan