

APPENDIX A

Report of Gregory L. Rosston, Ph.D.

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I. Introduction/Executive Summary

My name is Gregory L. Rosston. I am Deputy Director of the Stanford Institute for Economic Policy Research at Stanford University. I am also a Lecturer in the Economics Department at Stanford University. I received my Ph.D. and M.A. in economics from Stanford University, and my A.B. with honors in economics from the University of California, Berkeley. My specialties in economics are industrial organization and regulation with an emphasis on telecommunications. I served at the Federal Communications Commission (“Commission” or “FCC”) for three and one-half years as the Deputy Chief Economist of the Commission, as the Acting Chief Economist of the Common Carrier Bureau and as a senior economist in the Office of Plans and Policy. In these positions, I had significant involvement with the Commission’s spectrum policy and auction-related issues. I have been the author or co-author of a number of articles relating to telecommunications competition policy and spectrum policy, including an FCC staff working paper on spectrum policy. My Ph.D. dissertation studied the effects of FCC policy on the land mobile radio industry. I have also co-edited two books on telecommunications.

I have been asked by New ICO Global Communications (Holdings) Ltd. (“New ICO”) to analyze the Commission’s proposal to amend its rules governing the 2 GHz MSS licenses to allow the flexibility to provide ancillary terrestrial service. In particular, I would like to address the contention that the FCC’s ATC proposal would not be an efficient use of spectrum¹ and would result in an unfair windfall for MSS operators.² My analysis shows that consumers in all areas of the country will benefit from a forward-looking, market-based approach to spectrum management. Allowing additional flexibility for spectrum licensees will increase competition and the attendant consumer benefits. In addition, in this case, the flexibility holds the promise of helping to bridge the digital divide by increasing rural access to high bandwidth services and reducing the cost of service for poor urban residents. My analysis looks at the benefits for spectrum efficiency of allowing technical flexibility, the economics of satellite services, and then applies this to the 2 GHz MSS satellite service.

II. Spectrum Efficiency

The Commission has a mandate to manage the spectrum in the public interest. Historically, that meant dictating specific services to be provided using specific technologies for each set of frequencies. However, over the past 10 years, the Commission has moved toward a

¹ See AT&T Wireless Comments at 8.

² See AT&T Wireless Comments at 4, 11; Joint Comments of Cingular Wireless & Verizon Wireless at 10; TDS & USCC Comments at 12.

more flexible approach to spectrum management, allowing licensees to choose technology and the services provided.³ For example, rather than mandate technology for PCS licensees, the FCC set interference standards and had only minimal restrictions on the services that a new PCS licensee could provide. In recent policy statements and in its notice on secondary markets in spectrum, the Commission has indicated a desire to continue on this path.

In this new effort, we seek to significantly expand and enhance the existing secondary markets for spectrum usage rights to permit spectrum to flow more freely among users and uses in response to economic demand, to the extent consistent with our other statutory mandates and public interest objectives. We believe that an expanded system of private sector markets will serve the public interest by creating new opportunities for increasing the communications capacity and efficiency of spectrum use by licensees.⁴

In that secondary market proceeding, I participated in a filing with a group of 37 economists that encouraged the Commission to adopt a more market-based approach to spectrum policy than it has done to date.⁵ In those comments, we urged the Commission to pay particular attention to interference concerns, but not to dictate technology choice or service provision.

Chairman Powell recently gave a speech in which he also advocated a more market-oriented approach to spectrum management. “It is important that the Commission move from its traditional spectrum management paradigm of ‘command and control’ to a paradigm of market-oriented allocation policy to provide more flexible allocations that allow multiple uses so that spectrum can be put to its highest and best use.”⁶

If the Commission lets licensees decide on technology and service provision, service providers will have a strong incentive to investigate the market, evaluate technology and make choices that will most likely lead to success in the marketplace. Success in the marketplace is heavily dependent on providing services that customers find attractive. By allowing the entrepreneurs who get the licenses to realize the benefits and bear the risks from their choices, they are more likely to maximize consumer surplus when there is a competitive market.

Spectrum flexibility is also likely to lead to more innovation in spectrum use. Innovation is key to improving the service to consumers. Innovation induced by flexibility can take many forms – better services, lower prices and service to underserved areas. With the flexibility to develop new business plans and services, licensees will have the incentive to seize the opportunities rather than to plod through the procedures at the Commission that slow the process of new service introduction. Satellite services have significant room for improvement to make

³ The move has neither been complete nor without deviation.

⁴ “In the Matter of Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets,” rel. December 1, 2000, at 1-2.

⁵ “Comments of 37 Concerned Economists,” In the Matter of Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, Feb. 7, 2001. (“37 Concerned Economists”)

⁶ “Digital Broadband Migration” Part II, October 23, 2001, available at <http://www.fcc.gov/Speeches/Powell/2001/spmcp109.html>.

their services viable and flexibility may be the key that allows them to compete in the telecommunications marketplace.

The best way for the Commission to stimulate a competitive market for spectrum-based services (and to increase competition for wireline services from spectrum-based providers) is to make as much spectrum freely available to the market as possible. By this, I mean not only that the Commission should make the spectrum available to the market, but that it should make spectrum available with minimal restrictions. That way, many providers can compete in what were previously walled-off markets, spectrum will flow to its highest-value use, and consumers will gain.

A couple of examples of flexibility show the benefits. In the 28 GHz proceeding, the Commission originally envisioned LMDS to be a one-way competitor to cable television, as evidenced by its pioneer preference award to CellularVision. Later, when the spectrum allocation was finalized, the rules not only allowed one-way cable-like programming, but also allowed two-way voice, video and data. As a result, the LMDS licensees did not have to come back to the FCC to get permission to change the services or technology choice. They simply had to comply with interference rules.

A similar situation occurred with CMRS providers. All of the providers licensed to use cellular, PCS, and SMR spectrum bands — originally focused on voice communications. But many have added data capability, and many have also radically changed the transmission technology used.⁷ All of these mobile wireless providers are also expected to make further technological changes over the next few years to increase data throughput and capacity. The LMDS and CMRS examples show that there are many ways that the spectrum can be used to increase consumer benefits and competition at the same time.

Some parties may have incentives to object when the FCC grants increased spectrum flexibility, and this case is no exception. These complaints generally fall into two categories: equity and budget. Some parties will claim that it will be unfair to allow additional flexibility for certain licensees if they have not paid for that benefit.⁸ However, this misunderstands the market effect of flexibility and puts the interests of incumbents ahead of consumers. Each time the Commission grants flexibility, it will generally be to a class of all similarly situated licensees, not to a single licensee. In addition, the more the Commission makes it a practice to grant full flexibility, the more competition it will engender overall. Because flexibility will be the rule rather than the exception, parties will use their flexibility to compete with other licensees, including those with newfound flexibility. Thus, it is less likely that there will be a large windfall gain. Even if the grant of additional flexibility were a windfall gain, the Commission should still address whether consumer welfare would be enhanced more by the grant than by withholding or delaying the grant of flexibility in the hopes of garnering revenue. Obviously simply withholding the additional flexibility from the market would be the worst solution for overall welfare. Consumers will be the beneficiaries as licensees are better able to compete and

⁷ Cellular providers have moved from AMPS to digital (TDMA, GSM or CDMA), SMR providers have moved from analog to iDEN and some PCS providers have swapped digital technologies already.

⁸ See, e.g., Joint Comments of Cingular Wireless and Verizon Wireless, at 10-12.

provide services that may be better or cheaper. If consumer welfare is enhanced by granting spectrum flexibility, it is irrational to withhold that flexibility solely to prevent an existing licensee from benefiting.

Moreover, the Commission has in the past added flexibility to existing licenses without charging for it. For example, MDS licenses initially authorized analog one-way video service. Subsequently, the Commission authorized MDS licensees to provide two-way digital service. The Commission was essentially forced to grant these rights to MDS licenses *ex post* when licensees complained to the Commission that they would be unable to compete with a limited service offering. Rather than waiting for such complaints and petitions, the Commission should have awarded these rights initially.

Some may object to the grant of additional flexibility in a world where initial licenses are generally awarded by auction and additional revenues could be raised by auctioning or charging for flexibility. However, with additional flexibility for an existing licensee, there will generally only be a single firm, the current licensee on that spectrum, that values highly the additional flexibility that goes with the specific frequencies.

It may be possible to raise additional revenues, but auctioning additional flexibility where there is likely only a single party that values the specific additional flexibility is not likely to be feasible without creating unintended problems as well. Since competition for the flexibility rights is likely to be low, the only way to extract revenues would be to withhold some flexibility or guess at an appropriate reserve price and credibly commit to withholding flexibility rights if the reserve price is not met.⁹ It is extremely difficult for a government agency to make these types of market judgments, and the risk to consumer welfare from withholding is likely much greater than the benefits from increased auction revenue. As a result, the Commission should aggressively move forward to award maximum flexibility whenever and wherever it can.¹⁰

Flexibility in terms of service and technology will allow licensees to provide the services that consumers demand at the lowest cost. If the Commission does not allow flexibility, implicitly or explicitly, the Commission is determining that it knows better than the market what services and technologies are appropriate to maximize consumer welfare. This is extremely difficult for the Commission at any point in time, and certainly more difficult for long periods of time that are covered by spectrum licenses.

III. Economics of Satellites

Satellite services have two important economic characteristics relevant to this proceeding: substantial sunk upfront costs and broad coverage along with capacity constraints and coverage holes. Like all other wireless services, satellite services require access to spectrum with a reasonable level of certainty about the amount of interference that can be expected from

⁹ Others may bid strategically upon flexibility rights even if they have no desire or ability to use the additional flexibility simply to block flexibility for anticompetitive reasons.

¹⁰ See “37 Concerned Economists”, fn. 5.

other services and an understanding about the rights to emit transmissions that might cause interference to other service providers.

A. *Sunk costs*

Satellite services require significant upfront expenditures for the development and deployment of the satellite system. All wireless systems require upfront development expenditures, but unlike terrestrial wireless systems, it is physically difficult to modify the satellite equipment once it is in place. It is also difficult to re-deploy satellite system assets. This is an important point when it comes to investment incentives. Once a satellite is in orbit and configured for a particular service and frequency, the ability to re-use that equipment in other ways is limited. This is why the owners of the Iridium system planned to abandon entirely their system; a terrestrial wireless system would most likely be able to use tower sites and other equipment to provide other services – it would be unlikely to burn up the equipment rather than attempting to re-use it or sell it to another provider.

The prospects of high sunk costs can affect operators' entry decisions. Operators are more likely to resist entry into a market because the higher exit costs (or lower ability to recoup entry costs) lead to a lower expected profit. In other words, if a satellite operator expects to recoup nothing of its sunk costs in the case of a business failure, then the case of a business success must be expected to yield higher profits so that the expected overall profit is the same.

The Commission should adopt spectrum policies that allow competitive firms the ability to choose the business plan that maximizes expected profits. But the Commission should not put itself in the position of holding back on flexibility, only to be meted out to those companies that would otherwise fail. To do so would be bad spectrum policy and would create perverse incentives for firms in the marketplace

B. *Coverage*

Once a satellite system is launched, it can provide substantial geographic coverage; a LEO system can provide global coverage. If the system is operational, then it will broadcast signals everywhere – in the U.S. that means in the wilds of Montana and the streets of New York. The system operator will want to make the best use of the spectrum everywhere.

Since demand for wireless services per square mile is substantially higher in New York than in Montana, the operator will want to find a way to increase the use of spectrum in New York. In some cases, this may mean using more spectrum in New York and less in Montana, in other cases there would be different technical solutions.

Prior to entry and incurring sunk costs (and afterwards), a prospective service operator will make detailed calculations about the expected return on its service. The operator will only enter if it expects to make a profit. One way of thinking about the profit for the satellite business is to decompose (or separate) the profits into rural and urban profits acknowledging that there are substantial common costs in the provision of these services. The total return to a service operator can be thought of as the return in rural areas plus the return in urban areas. The analysis

below assumes first that the demand is not interrelated (dependent on roaming, network effects, or economies of scale). Subsequently, these features are added to the analysis.

As discussed above, a satellite operator will have large fixed costs. To ensure the ability to cover those costs, the operator will need a substantial number of customers. It is quite possible that rural customers alone will be insufficient to cover the marginal cost as well as a sufficient contribution to cover the large fixed costs. Simply because there are more customers in urban areas, the opportunity to make contributions to cover the fixed costs of the satellite may be greater. In addition, spectrum is scarcer in urban areas so that service in urban areas may provide higher value as well. If the satellite operator can increase the number of urban customers through any of several spectrum conserving mechanisms or increase the value of urban service, it can provide greater consumer welfare and more intensive use of the spectrum. This can help it to cover fixed costs of the satellite system.

Providing attractive services for urban customers becomes even more important if rural and urban demands are interrelated. Urban coverage may contain numerous and significant holes. Coverage holes can occur because of building blockages, or an inability of signals to penetrate buildings. Because of these holes, a system may not be able to provide its advertised or desired “ubiquitous” coverage. If a selling point of a system is coverage anytime, anywhere, then a businessperson in Manhattan would be distressed to find the wireless communication device unable to function in her office and consequently might not trust the coverage in remote areas. Depending on the demand for service, holes in Manhattan could make the service in remote areas significantly less attractive. For example if a substantial part of rural demand is due to “roaming,” then rural demand would be lower if service in urban areas were not high quality. A satellite system alone may not be able to provide the same level of coverage that a hybrid system could. The flexibility to deploy a hybrid system, with terrestrial and satellite links, may substantially improve the customers’ service and the efficiency of the system.

In addition, there may be benefits to all customers from increased use of the network technology. Manufacturers of network equipment may be able to realize economies of scale if demand is larger. For example, rural subscribers may benefit from the adoption of network services by urban customers because it reduces equipment costs. If a large number of customers use the same technology, there may be more investment in the development of enhanced versions of the user equipment and complements to the equipment. One of the reasons cited for the dominance of Windows as an operating system is the abundance of applications written to operate in the Windows environment. More applications are written for the Windows environment than for other operating systems because there are more Windows users. If there are more users with MSS end user equipment because of attractive service in urban areas, then the rural customers may benefit from lower prices and more abundant supply of equipment and accessories. Satellite providers may be able to benefit from the network effects if they provide attractive enough service. The operators will be able to make the tradeoff in determining the additional cost of manufacturing equipment capable of operating in satellite mode and terrestrially compared to the benefits they get from a larger market. Only with the flexibility to offer different kinds of service will the licensees be able to make the appropriate choice of service and technology.

IV. Application to 2 GHz MSS

The Commission proposes to authorize New ICO and other MSS operators to provide an integrated satellite-terrestrial service in which the “ancillary terrestrial components,” or “ATCs,” use the same 2 GHz MSS spectrum that the satellite component uses. The general analysis above is perfectly applicable to the Commission’s ATC proposal. If New ICO is able to provide service to rural areas and urban areas using the same spectrum in different ways that serve consumers and does not create interference for other users, then there is no public policy reason to interfere with efficient pro-consumer use of spectrum. In fact, there are good policy reasons to support spectrum flexibility in addition to the general spectrum policy reasons. Additional flexibility for systems that have the potential to provide service to rural areas can help to bridge the digital divide efficiently and to reduce government involvement and subsidy programs.

New ICO has also suggested an innovative way to implement the Commission’s proposal, by coordinating and integrating satellite and terrestrial systems to provide service to customers. This innovative service idea can only come to fruition through flexible use of spectrum allowed by the Commission. There are likely to be many different innovations in the future of telecommunications systems and those innovations are more likely to occur in an environment where the innovator does not have to disclose innovations to the Commission and ask for permission to modify its business plans. In this case, New ICO has an innovation and the FCC rules require it to get permission to modify its proposed service. Modification of the rules will not only permit innovation in the 2 GHz MSS band, but will also stimulate innovation in the future as other entrepreneurs will see the chance to implement their visions also.

The Commission proposes to allow terrestrial use of the 2GHz MSS spectrum on an ancillary basis only after the construction and commencement of commercial operation of satellite service. New ICO hopes that this ancillary service will help it to fill coverage holes in urban areas and increase capacity in both urban and rural areas (by freeing spectrum that would otherwise be used on satellites to cover urban areas for use in rural areas). New ICO states that it plans a fully integrated system to insure coverage and to minimize interference problems. As a single integrated provider on this spectrum, New ICO should be able to internalize interference concerns as well as dynamically manage the spectrum to insure most efficient usage. At the same time, New ICO should face competition from other MSS providers (who would also have the right to offer similar integrated terrestrial/satellite services) and many other wireless and wireline providers.

Under the Commission’s ATC proposal, New ICO and other MSS operators could provide global satellite coverage with enhanced coverage in urban areas provided by terrestrial towers. It is my understanding that the Commission has licensed this spectrum to MSS licensees on a typical satellite sharing basis to avoid mutual exclusivity. The addition of a non-interfering terrestrial adjunct to any of the satellite licensees should increase the potential usefulness of that spectrum in a system like that contemplated by the ATC proposal.

There may be concern that adding ancillary terrestrial capabilities to the satellite licenses will cause the terrestrial component to be the primary use and create equity concerns. Concern

for the promotion of satellite technology and use of this spectrum should be ameliorated by the Commission's proposal that ancillary terrestrial use be authorized only after the primary satellite system has been launched and commercial operation has begun. The significant upfront and sunk costs of satellite systems increase the likelihood that the licensees would operate their satellite systems, especially in underserved rural areas that will be more expensive to serve by terrestrial means. In any case, to prohibit terrestrial use would diminish the usefulness of the spectrum.

Although auctions are generally good for consumer welfare, they are not an end in themselves. The primary goal of spectrum policy should be to get spectrum licenses into the hands of those licensees that value it most highly and will ultimately provide the services consumers demand most highly. Auctions are generally the way to award new spectrum, but in certain cases consumer welfare may be increased by rapidly awarding spectrum rights to the market. For example, I have explained above that simply awarding additional flexibility to license authorizations without auction when there is a single licensee able to use the rights is likely to increase consumer welfare relative to a system of trying to extract payment for such rights. In this case, the Commission has awarded licenses to MSS providers and the Commission should grant the flexibility to provide terrestrial service in conjunction with the satellite rights since it appears it would be difficult for anyone other than the satellite licensee to coordinate the spectrum use.

The Commission should use its ability to grant spectrum flexibility to encourage New ICO and other MSS operators to provide narrowband and broadband access to rural areas at a reasonable cost. Much of the Commission's 2 GHz order stated concern with and proposed mechanisms to address service to rural and unserved areas.¹¹ Flexibility and the resultant innovation should help provide service to rural and unserved areas.

The current universal service scheme to provide subsidized access in high cost areas is extremely expensive. If a more efficient provider can provide competition to the high cost wireline telephony providers, there will be substantial benefits. First, rural consumers will receive the benefits of competition in service provision. Second, it may save hundreds of millions of dollars in universal service transfers because of the potential for cost reductions. This competition may be even more important in the future as political demand builds to subsidize broadband service into rural high-cost areas. To the extent that service can be provided at attractive prices without a subsidy, we eliminate the need for excessive taxes on urban customers (many of whom are poor) and we reduce the need for regulation overall.

There are clearly many ways to provide satellite coverage in rural areas and terrestrial coverage in urban areas. One example would be the use of dual band equipment. Clearly this is one alternative. But it would be a large policy mistake for the Commission to require that this solution be adopted. There are many possible problems with such a solution and it may be impossible to implement. There also may be technical problems that make New ICO's solution impractical eventually. The best answer for the Commission is to ensure that interference

¹¹ See "In the Matter of The Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band," released August 25, 2000, especially section II.A.1.d.

concerns are addressed and that the spectrum be licensed expeditiously so that the licensees can be free to invest and bring their services to market.

V. Conclusions

The Commission's proposal to increase the usefulness of the spectrum could be a big gain for consumers. If the New ICO system works as described, consumers overall would gain from the introduction of an additional competitor in the marketplace. Rural customers would gain because they would have access to a new source of high-speed bandwidth where none existed before. This would allow these customers to join the digital age. Allowing additional flexibility would also benefit urban customers. They would get better service from the spectrum because the MSS companies would target them with attractive services delivered both terrestrially and via satellite. They would also benefit from the reduction in the steady upward pressure on universal service funding that falls on the backs of urban subscribers.

Some of these gains might arise without the modification to the licenses. But there is no cost to allowing the modifications. Without the modifications, the spectrum could lie uselessly fallow, and there would be a risk that none of the satellite benefits would be realized because the satellites would not launch or would not realize the beneficial network effects, and be stuck in a low-level equilibrium rather than a high level equilibrium with lots of customers and vibrant service. To take this risk with no offsetting benefit makes no sense.