EX PARTE OR LATE FILED

PIPER & MARBURY
1200 NINETEENTH STREET, N.W.
WASHINGTON, D. C. 20036-2430
202-861-3900
FAX: 202-223-2085

BALTIMORE
NEW YORK
PHILADELPHIA
LONDON
EASTON, MD

RONALD L. PLESSER
202-861-3969

DOCKET FILE COPY ORIGINAL

July 21, 1993

HAND DELIVERY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Room 222
1919 M Street, N.W.
Washington, D.C. 20554

RECEIVED
JUL 21 1993
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Re: GEN Docket No. 90-314
ET Docket No. 92-100
Ex Parte Presentation

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules, this is to advise you that, on behalf of PCS Action, Inc., a coalition of companies to promote the deployment of PCS services, I submitted today a memorandum entitled "White Paper on PCS Spectrum Issues" to Chairman James H. Quello, Commissioner Ervin S. Duggan, Commissioner Andrew C. Barrett, Robert M. Pepper, Chief, Office of Plans and Policy, and Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology.

In accordance with the Commission's rules, I am hereby submitting one original and one copy of this memorandum and its attachment for each of the above-referenced proceedings.

Very truly yours,

Ronald L. Plesser

Ronald L. Plesser

cc: Chairman James H. Quello
Commissioner Ervin S. Duggan
Commissioner Andrew C. Barrett
Mr. Robert M. Pepper
Mr. Thomas P. Stanley

Enclosures

No. of Copies rec'd 0+1
List A B C D E

PCS *ACTION, INC.*

1200 19TH STREET, NW • 7TH FLOOR • WASHINGTON, DC 20036 • (202) 861-2957 • FAX: (202) 861-3963

WHITE PAPER ON PCS SPECTRUM ISSUES

July 21, 1993

Of all the issues facing the Commission as it authorizes personal communications services ("PCS"), the most crucial is the size of the spectrum allocation to be authorized for PCS licensees. The amount of spectrum PCS licensees will be permitted to utilize will determine the number of Americans who can be served by PCS, the speed with which PCS will be deployed, the voice quality PCS will be able to attain, whether highly demanded PCS data transmission will be feasible, and whether PCS will be a viable competitor to cellular telephony and, ultimately, the local exchange -- in short, whether PCS will succeed or fail.

The members of PCS Action -- telecommunications equipment manufacturers, entrepreneurs, multi-media companies, an interexchange carrier and a cellular service provider -- believe strongly that an allocation of 40 MHz per PCS licensee is necessary. Those who advocate lesser allocations are merely attempting to prevent PCS from reaching its full potential in the marketplace, or fundamentally misunderstand the nature of PCS and the constraints facing its implementation in a shared spectrum environment. An allocation of 40 MHz per licensee is not excessive or extravagant; it is simply the allocation that the science underlying PCS demands. The major manufacturers that will design and build PCS equipment -- including Motorola, Northern Telecom, Omnipoint and Qualcomm -- agree that a 40 MHz assignment per licensee is imperative to permit PCS to be implemented in the United States, particularly given the Commission's Emerging Technology decisions grandfathering incumbent microwave systems. This allocation is consistent with the vision American consumers hold for PCS, as well as with PCS assignments by our international competitors, which are moving ahead to implement PCS this year with allocations that are effectively larger than any option being considered by the Commission.

I.
The American Vision for PCS

The decisions surrounding the implementation of PCS need not be made in a vacuum. The PCS industry has undertaken some 200 PCS technical and marketing experiments and has conducted a significant amount of research into the characteristics American consumers will demand of PCS. Each study establishes conclusively that American consumers will embrace a PCS that is fully featured and would reject any vision of PCS that delivers less.[1/] American consumers demand high-quality voice and data services, high capacity, high-speed handoff, and wide-area coverage -- PCS with a capital "P". Systems offering only small service areas because of limited spectrum would be rejected out-of-hand by the American consumer.

Studies emphasize the importance for PCS of broad coverage, high voice quality, full functionality, and data applications.[2/] Affordability and accessibility boosts usage of PCS services,[3/] and the successful introduction of PCS will mean an acceleration in the penetration of all wireless services.[4/]

International experience with the actual implementation of PCS corroborates the results of American PCS experimenters. In the United Kingdom, for example, four CT-2 licenses were issued in 1989 and only one CT-2 licensee now survives. CT-2 licensees could provide only services with limited coverage, mobility, and functionality. Licensees were unable to provide the full-fledged wireless services British consumers, like American consumers, demand.

These findings have led telecommunications companies developing PCS services to plan the deployment of affordable services that will enable individuals to communicate

---

1/ See PCS Trial Results: A Telocator Survey 1 (1993) ("users chafe at coverage restrictions and broad coverage is the top priority for trial participants . . . users want cellular-like service -- including two-way calling and the ability to hand off -- priced lower than cellular").

2/ See, e.g., id. at 1 & 4; Deloitte & Touche, User Perspectives on the Future of Wireless Communications (1992).

3/ See, e.g., American Personal Communications, Seventh Progress Report, FCC File No. 2056-EX-MP-91 (April 28, 1992)

independent of location, access method, and information format, with a maximum of user call management control.

Multi-feature PCS services are projected to be available to individuals at any location, whether at home or office, or in transit or in public. PCS services will evolve from secure, high-quality voice and text transmission with national roaming, to fixed and mobile ISDN data, telemetry, broadband data, advanced intelligent network services, and multimedia. They will facilitate the freedom, security, efficiency, and control that result from specialized personal and business mobility.

PCS will mark the forefront of universal personal telecommunications services in which any communication an individual needs -- whether in high-quality voice, wideband data, or multimedia -- is available from any point.

II.
The Realities Facing PCS Implementation

PCS will be authorized in a band that now is populated by some 10,000 private operational fixed microwave users. These incumbents include, in the main, utilities, public safety licensees, governmental entities, and the railroad and petroleum industries. These interests have fought vigorously and effectively before Congress and the Commission for the right to remain in the 2 GHz band, protection from interference, and compensation for relocating microwave links. Even assuming full cooperation by both microwave and PCS licensees, however, the relocation process will span a number of years.

The Commission has decided to grandfather public safety and certain other licensees permanently and to require a "transition period" of three years before any other microwave incumbent can be relocated from the band involuntarily.[5/] After the expiration of the "transition period," incumbents can be relocated involuntarily but only with the PCS licensee paying all the expenses of relocation (estimated at between $135,000 and $250,000 per path). Before the expiration of the "transition period," a PCS licensee can relocate an incumbent only by persuading it to relocate voluntarily -- that is, by paying it whatever the market will bear in exchange for it vacating frequencies needed for PCS. Even involuntary relocation is to be handled on a case-by-case basis, and is likely to be a lengthy process at best.

5/ See Procedures Adopted for Emerging Technology Access to 2 GHz Spectrum, FCC ET Dkt. No. 92-9 (News Release July 15, 1993).

The presence of incumbents that either will remain permanently in the 2 GHz band or that cannot be relocated for a period of years raises two key issues. First, how much spectrum is required to permit PCS licensees to inaugurate PCS, during the "transition period" and beyond? Second, what would a regime under which insufficient spectrum allocations force massive relocations imply for the consumer cost and timing of a nationwide roll-out for PCS?

A.

The Need to Share Spectrum. Every spectrum-availability study that has been performed has found conclusively that PCS spectrum allocations of 20 MHz, or even 30 MHz, would be insufficient for implementation of PCS in major markets. The need for a sufficient amount of spectrum to permit PCS to be implemented in a shared environment is simply a scientific fact of life PCS licensees and the Commission must face.

Early studies found, quite correctly, that there is a substantial amount of unused spectrum in the 140 MHz of the

American public. For any sharing technology effectively to "work around" incumbent users, however, there must be at least some spectrum available. Just as one cannot drive a car around an obstacle if the obstacle blocks the entire road, it is physically impossible for a PCS licensee to share with microwave if all its spectrum is blocked by microwave incumbents.

Under a 20 MHz allocation, for example, one microwave licensee could block PCS from being implemented in a large portion of the geographic area covered by a PCS license.[7] Microwave licensees typically utilize two 10 MHz channels -- a total of 20 MHz -- that will correspond to PCS allocations. (When the use of IF filters on microwave receivers is taken into account, moreover, some microwave users can require interference protection for bandwidths of between 17 and 28 MHz per channel.) Microwave protection criteria, in their current versions, require consideration of systems within 250 miles in every direction. One microwave incumbent, then, can stymie the implementation of PCS for the entire service area of a PCS licensee if spectrum blocks are only 20 or 30 MHz wide. Because there are 10,000 microwave licensees, at least one-quarter of which will be permanently grandfathered, and because these licensees are spread throughout the United States, a 20 MHz allocation for PCS equates to zero spectrum available for PCS in significant portions of the country. The PCS industry would never develop under these constraints, and federal auction revenues for PCS licenses would be minimal.

Studies examining PCS implementation in specific markets confirm this result. In one study, American Personal Communications analyzed each microwave path in each of the largest 11 United States cities for each of the Commission's spectrum allocation proposals -- 40 MHz per licensee, 30 MHz per licensee, and 20 MHz per licensee. The study found that allocations of 20 MHz and even 30 MHz would yield too little

---

7/ See Comsearch, Analysis of the 20 MHz, 30 MHz, & 40 MHz PCS Block Allocations, filed with MCI Telecommunications Corp., Comments (Gen. Docket 90-314, Nov. 9, 1992). Comsearch is an

usable spectrum to permit PCS to be deployed.[8/] In Chicago, for example, an allocation of 20 MHz results in, depending upon the PCS licensee, between 33 percent and 57 percent of the area not having spectrum available for PCS.

In another study, Cox Enterprises analyzed each microwave path in San Diego, California, and concluded that 20 or 30 MHz allocations would render PCS an impossibility -- 10 of the 24 incumbents in San Diego are public safety licensees, and even a 30 MHz allocation would be insufficient.[9/] Other markets show similar results.

Even if microwave paths can be relocated by private negotiation in the near term, the problem of spectrum congestion will not magically disappear. Even assuming that each PCS licensee can relocate the three worst-case microwave links from that PCS licensee's spectrum block in each major market -- which will not be possible in all cases[10/] -- the amount of spectrum available for PCS use would increase, on average, only slightly. In Los Angeles, for example, a 30 MHz allocation would yield only an average of 16.9 MHz of useable spectrum even after the three worst-case microwave stations in each PCS licensee's spectrum block had been relocated and a 20 MHz allocation would yield only 12.1 MHz of useable spectrum, on average, under the same circumstances. Included in these averages, moreover, is a significant amount of area in which there would be <u>no spectrum at all available</u> even after all three worst-case microwave users are relocated -- under a 30 MHz allocation, up to 22.9 percent of the geographic area in Los Angeles has no spectrum available for PCS; under a 20 MHz allocation, up to 32.8 percent of the area of Los Angeles has no spectrum available. In Chicago, only 14.2 MHz of useable spectrum, on average, would be available under a 20 MHz

---

8/ <u>See</u> American Personal Communications, <u>Report on Spectrum Availability for Personal Communications Services Sharing the 1850-1990 MHz Band with the Private Operational Microwave Service</u> (Gen. Docket 90-314 & ET Docket 92-9, November 1992). Data for this study was obtained from Comsearch and FCC files.

9/ <u>See</u> Cox Enterprises, Inc., Reply Comments, pp. 10-11 & Comsearch Appendix (Gen. Docket 90-314, Jan. 8, 1993).

10/ If any of these licensees is a public safety entity, or would be entitled to remain in the 2 GHz band for technical reasons, or would simply refuse to move during the "transition period," the PCS licensee would be powerless to relocate them and any potential spectrum gains from a theoretical relocation would not be realized.

allocation after relocation of the worst three microwave stations by each licensee and up to 36 percent of the Chicago area would have no spectrum available. In Houston, only 13.5 MHz of useable spectrum would be available, on average, with a 20 MHz allocation after relocating the three worst-case incumbents in each PCS licensee's spectrum block and up to 35.2 percent of the Houston area still would have no spectrum available for PCS.[11] These results are, again, only averages; in each case, significant geographic portions of the market are blocked entirely by microwave users.[12]

Studies have focused on major markets for good reason. If PCS cannot be brought to the major population centers of the United States, it will never emerge as an effective telecommunications service. Moreover, some 50 percent of Americans live in or near the top ten major trading areas, where microwave congestion is and will be a significant problem. However, microwave usage is not solely a large city phenomenon. Microwave users operate throughout the United States, in mid-size cities, small towns, and rural areas. Cities such as Orlando, Florida (36 paths, 32 public safety) and even Tulsa, Oklahoma (24 paths, 11 public safety) and Bismarck, North Dakota (15 paths) have significant microwave usage.[13] Microwave congestion under allocations as small as 20 MHz will be a fact of life even in sparsely populated areas, because a single microwave user can block all spectrum in a PCS licensee's assigned frequencies. Microwave congestion in the 2

11/ See Engineering Supplement of J. Barclay Jones, Attachment A to Letter from Wayne N. Schelle to Chairman Alfred C. Sikes (Gen. Docket 90-314, Jan. 8, 1992).

12/ For this reason, it is meaningless to point out that the Hong Kong digital cellular system has been allocated only 5 MHz of clear spectrum. This allocation would be uniformly clear throughout the entire geographic area to be served; under an allocation that yields an effective average of 5 MHz, after sharing, entire geographic areas would be blocked out entirely by microwave use. Moreover, PCS is not digital cellular. Because of the size of this allocation (which may have to be supplemented to meet capacity demands when commercial service is inaugurated), the Hong Kong system will be limited to compressed voice service. PCS in the United States will be much more than simply a voice service (as will, for that matter, cellular).

13/ See Comsearch, Microwave Path Usage On 1850-1990 Band (Gen. Docket 90-314, April 1993).

GHz band is a nationwide problem demanding a nationwide solution.

The fact that some PCS applications will permit some use of microcells -- generally defined as base stations with radii of 1000 feet -- does not obviate the need for a sufficient spectrum allocation. To begin with, any vision of a PCS based entirely on microcells is not in the business plan of any PCS Action member (or any PCS proponent of which we know). Base station radii of up to three miles will be necessary for

stall PCS implementation and development in markets across the country because PCS licensees would not have access to the spectrum needed to implement PCS. PCS licensees would be forced to abandon the sharing technologies that the Commission has found so valuable and revert to a mandated band-clearing strategy. Forcing a clearing of the band would provoke delays of two types.

First, too-small allocations would prevent PCS licensees from having sufficient spectrum even to begin PCS implementation in the near term. Comsearch, an independent frequency coordination firm, has found that a 20 MHz PCS allocation would require 100 percent of public safety licensees and 50 percent of all licensees to be relocated during the first three years after PCS licensing.[15/] PCS licensees thus would be forced for their very survival to begin negotiations with incumbent microwave users during the "transition period."

During this "transition period," microwave users would be under no obligation to relocate or to limit their demand for payment to their costs of relocating. PCS licensees, fresh from paying auction prices to attain PCS spectrum, would be forced to negotiate in an open market -- essentially, a second, private auction -- to gain access to the very spectrum they had been licensed. Microwave licensees, moreover, will have every incentive to attempt to reap the perceived market value of the spectrum they have been licensed. These negotiations would be inordinately time-consuming and expensive, delaying service to the consumer and driving up the cost of the service that ultimately will be provided. Under this scenario, PCS stands to lose the very characteristic that has driven the optimism of the PCS industry -- the ability to offer a low-cost, mass market service that will meet, for the first time, the tetherless telecommunications needs of the majority of the American public.

Second, even if negotiations can be completed successfully, the logistics of relocating microwave licensees would cause significant time delays. Too-small spectrum allocations would require all PCS licensees to be working to relocate microwave users at essentially the same time. Equipment for relocation bands, which are just now being rechannelized by the Commission, would have to be produced in mass quantities in time for this relocation; innumerable engineers would have to be deployed to effectuate the relocation. Although some have intimated that relocation of

---

15/ See Comsearch, Spectrum Allocations and Their Impact on Microwave User Relocations: A Case Study (April 12, 1993).

microwave users requires little more than switching microwave radios, this is not the case. Many systems are complex with multiple paths, and will require substantial time to perform the frequency coordination, engineering, licensing and installation. Today this process often takes 18 months for a single link. If relocations such as these will be necessary in every major market in virtually the same time frame, the

requiring quick regulatory action to begin the licensing of PCS. Insufficient spectrum allocations would frustrate the very goals Congress expected to achieve by mandating quick regulatory action.

III.
Other Reasons for 40 MHz Assignments

As pivotal as the microwave congestion issue is to the debate over spectrum allocations, it is not, by any means, the sole reason for an allocation of 40 MHz per PCS licensee. Throughout the world, countries have forced incumbent microwave users to vacate the 2 GHz band altogether to accommodate PCS and then have granted 30-50 MHz of clear spectrum to PCS licensees. In the United Kingdom, for example, two PCS licensees each have been allocated 50 MHz of clear spectrum, and in Germany, one PCS licensee has been allocated 30 MHz of clear spectrum. This is not inefficient or uninformed spectrum management policy on the part of these countries, to be sure; rather, these countries are seizing the opportunity to permit PCS to provide much more than simply a digital cellular service. The same path should be followed here.

The Population to be Served. Cellular companies serve some 4 percent of the United States' population on 25 MHz of clear spectrum, and now claim to be at capacity in major markets. Independent marketing studies suggest that between 40 and 60 million Americans -- up to 25 percent of the population of the United States -- will subscribe to PCS. Even if clear spectrum were being assigned to PCS licensees, a significant amount of spectrum would be necessary to serve such a vast number of Americans even with efficient digital technology.[21/] In fact, a comprehensive study on spectrum requirements performed by Telocator found that PCS operators will need

---

21/ Although PCS will utilize efficient digital technology, cellular carriers too are converting to technology promising the same degree of efficiency. The claim that "less is more" because PCS can utilize tiny microcells and even picocells to reuse spectrum more effectively is a complete red herring. No one questions that cellular licensees could install smaller cells as well. This vision, moreover, is based on the limited, small-cell-only vision for PCS held by our competitors. Even assuming such systems would be built, this requirement would significantly raise the cost of initiating PCS service.

between 36 and 49 MHz of clear spectrum each to service the public's demand for PCS.[22]

The Need for Wireline-Quality Voice. Voice quality is a crucial issue emerging from the American studies of the potential market for PCS. American consumers will demand wireline-quality voice transmission. If wireline-quality voice cannot be achieved, PCS will not be able to break the local exchange monopoly and provide competition in the local residential service. High-quality voice transmission demands high-capacity voice coders ("vocoders"). Vocoder rates providing high voice quality cannot be accommodated in very narrow spectrum allocations. The Telocator spectrum study also found that 36-49 MHz of clear spectrum per licensee would be required for an "optimistic" deployment of current technology using 32 Kbps voice coding.[23] The implementation of effective in-building PCS, or any other PCS uses that will require consumers to replace traditional wireline services with wireless service, will require wireline-quality voice transmission.

The Need for Data Transmission. PCS is, emphatically, more than a voice service. Wireless data transmission is one of the most highly demanded members of the PCS family of services. Wireless computing devices -- including laptop and notebook computers as well as "personal digital assistants" -- must be served by a robust and high-quality digital transmission system. Wireless facsimile services and data modem communications alone will require 32 Kbps transmission for acceptable performance; advanced digital interfaces such as wireless ISDN will require at least 64 Kbps per user. Given any significant level of penetration and usage, these services simply cannot be wedged into allocations smaller than 40 MHz per PCS licensee.

PCS is ideally positioned to provide an infrastructure for wireless computing. In addition, PCS can and should take the

encompass high-speed wireless facsimile services and large-capacity data transmission services. The new high capacity, wired computer networks are expected to be image and video driven. Newspapers, for example, will deliver news on personal digital assistants with on-command videos of events and sound recordings of speeches, not mere scrolling of text. More fundamentally, if the personal digital assistant of the future cannot match the wired computing network's ability to decompress a multimedia file on the fly or to support a video call, the future mobile user and the mobile network will be cut off from the standard way of doing business.

These new applications will require significant bandwidth. Using an asymmetric algorithm, for instance, every multimedia session would require occupying bandwidth that could have accommodated simultaneous voice channels ranging in number from approximately 10 (at vocoder rates of 32 Kbps) to 50 (at 9.6 Kbps). This demand for bandwidth makes it very unlikely that PCS can provide high-speed data services if these services must contend for less than 40 MHz of shared spectrum. PCS's potential data applications would be forever lost under 20 MHz and 30 MHz spectrum allocations.

The Potential for Information Services. PCS also can provide highly demanded information services, including graphics, imaging, and, in time, compressed video in real time. These applications will permit advances in health care delivery and education, particularly in less densely populated areas, and could revolutionize how businesses communicate. The potential for cutting-edge wireless multimedia applications is an important part of our vision for PCS; this vision will expand access to information to large sectors of the American public that have not yet been able to participate in the telecommunications revolution. These services will be lost to the American public if PCS does not receive an adequate spectrum allocation.

IV.
Rural Allocations

Some may argue that rural areas will not require the same intensive use of the spectrum that will occur in densely populated urban areas. One should not, however, leap to the conclusion that it is an inefficient use of spectrum to allocate 40 MHz per licensee throughout the United States, including in rural areas. Rural telephone companies may put PCS spectrum to intense use by serving traveling and commuting subscribers from surrounding areas and using another portion of PCS spectrum to replace archaic wired infrastructures with advanced, cost-effective digital wireless voice and data

services. The flexibility of use inherent in PCS spectrum may finally permit those living in rural America to be every bit as advanced a part of our national telecommunications infrastructure as are our urban citizens.

The fact that all rural areas may not require 40 MHz per PCS licensee should not be seen as inefficient but instead should be viewed as a necessary side-effect of the manner in which the Commission has allocated spectrum for more than 60 years. It also could be argued, for example, that it is inefficient to protect the same 400 MHz of spectrum for VHF and UHF television in Truth or Consequences, New Mexico and New York City. It is undoubtedly more efficient to license PCS spectrum to some entity, even in rural areas, than to permit it to lie unassigned and fallow. It would make little sense to create a regional patchwork quilt of allocations, and it would make even less sense to define the services that will be available in cities by spectrum needs that are perceived in less-populated areas.

V.
Conclusion

PCS can reach its full potential in the United States only if PCS licensees have access to a sufficient amount of spectrum to avoid interference to incumbent microwave users, provide high-quality voice and high-capacity data transmission services, and respond to the service demands of consumers in

COVINGTON & BURLING
1201 PENNSYLVANIA AVENUE, N.W.
P.O. BOX 7566
WASHINGTON, D.C. 20044
(202) 662-6000

TELEFAX (202) 662-6291
TELEX 89-593 (COVLING WSH)
CABLE COVLING

EX PARTE OR LATE FILED

ACHESON HOUSE
48 HERTFORD STREET
LONDON W1Y7TF ENGLAND
TELEPHONE 44-71-495-5655
TELEFAX 44-71-495-3101

BRUSSELS CORRESPONDENT OFFICE
44 AVENUE DES ARTS
BRUSSELS 1040 BELGIUM
TELEPHONE 32-2-512-9890
TELEFAX 32-2-502-598

KURT A. WIMMER
DIRECT DIAL NUMBER
(202) 662-5278

April 15, 1993

RECEIVED
JUL 21 1993
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

BY MESSENGER

Ms. Cora Beebe
Office of Management and Budget
New Executive Office Building
725 17th Street, N.W., Room 9202
Washington, D.C.

Re: Personal Communications Services

Dear Cora:

As we discussed last week, we have estimated that the inauguration of personal communications services ("PCS") would create 300,000 good new jobs. This estimate is consistent with an estimate by Telocator[1] that 250,000 service jobs and 50,000 manufacturing jobs would be created by the implementation of PCS. Telocator also has estimated that 60,000,000 Americans will subscribe to PCS by the year 2002.

Our specific analysis shows that PCS will create some 280,867 jobs by the year 2008 (or by 2002 under Telocator's projections). These jobs would be created in three broad categories: direct employment by PCS companies, indirect employment, and manufacturing employment.

Direct Employment (102,134 jobs). The analysis begins with employee-subscriber ratios drawn from other start-up telecommunications industries. At mid-point in the PCS industry's development, the analysis utilizes employee-subscriber ratios consistent with current cellular industry

---

[1] Telocator is a long-standing trade association representing companies in the cellular, paging and personal communications industries.

employment.[2] Rather than continue with that ratio, the analysis utilizes more conservative ratios as the PCS industry grows to reflect greater efficiencies being realized.[3]

Indirect Employment (127,667 jobs). This category includes dealers, distributors, resellers, consultants, engineering, billing and maintenance contractors, and other types of jobs that are created indirectly by the activities of PCS licensees. It is based on ratios that have been experienced in the cellular industry, which provides a useful analogue for PCS. The use of cellular figures is conservative in that PCS may be significantly more infrastructure-intensive than cellular and thus produce more indirect employment in engineering and construction services in its growth years.

Manufacturing Employment (40,853 jobs). The analysis assumes an export-import ratio of only 1:1.25 (that is, we export 25 percent more than we import). This is also quite conservative; as you know, our balance of trade in wireless telecommunications equipment traditionally is quite good and will improve if we can implement PCS swiftly and thus gain a foothold in the immense international market for PCS.[4]

---

[2] This analysis is very conservative in that it begins with employment ratios associated with the cellular industry rather than significantly lower ratios associated with the landline telephone industry (which if applied to PCS would probably double our job estimate). Some would argue that the latter figures may be more appropriate for PCS in the long run, because PCS will become more of a competitor to local exchange telephony as it matures.

[3] This analysis is significantly more conservative than some analyses that analyze PCS at maturity based on current cellular employment figures (that is, the cellular industry has created 100,000 direct and indirect jobs with 11,000,000 current subscribers; if the PCS industry serves 60,000,000 subscribers at maturity, it should employ more than five times as many employees, or at least 500,000).

[4] Many would argue that this figure is very conservative because the types of PCS being developed in the United States will leapfrog over more rudimentary technologies being developed in the European Community and the Pacific Rim. If PCS is implemented swiftly, the United States will capture a greater share of the international equipment market, a

The number of jobs created per dollar of manufacturing output is consistent with the current employment practices of large telecommunications manufacturers with whom we consulted in crafting this analysis.

Please give me a call with any questions about this analysis. We have not forgotten your invitation for comments on specific auction processes that could be utilized and will provide comments to you on that matter soon.

Very truly yours,

Kurt A. Wimmer

Enclosure

cc: Ronald L. Plesser, Esq.

---

higher export-import ratio would be justified, and more jobs would be created.